YAMAHA DX7 DIGITAL SYNTHESIZER

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FOREWORD

The DX series of synthesizer represents a major advance in music making capability, but because of their complexity few people ever try to use them to their full potential.

This manual provides a step by step guide to the DX7's controls, and suggests a reasonably logical progression for sound creation. Whilst it does not cover everything, it does provide a foundation on which to build confidence in using the DX, and is therefore thoroughly recommended.

Tony Wride
DX Owners' Club
Great Britain.

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CONTENTS

DX-7 Control Panel
Preface 6

CHAPTER 1

The DX-FM Sound Source 8
What is an Operator? 8
Two Operators 9
Tickling an Operator 9
All about Tickling 10
Algorithm - Groups of Operators 10
Play Mode - Edit Mode 11
ON/OFF Operator 12
Changing an Algorithm by Data Entry 12
Waveforms and Harmonics 14
Output Level 15
Feedback and Output Level 16
Frequency Coarse 16
Frequency Fine 17
Modulator Frequency 17
Frequency Ratio of Modulator to Carrier 18
Frequency Ratios of the Carrier and Modulator 19
Envelope Generator 20
Simplified EG 22
Changing the EG Data 22
EG Copy 23
Comparing Set Data with Original Data 24
Setting a 'Strange' Envelope 24
Naming the Produced Tone Colours 25
Storing of Tone Colours 25
Edit Recall 26
How is Edit Recall possible? 27

CHAPTER 2

1. MAXIMUM USAGE OF EDIT MODE 30

(1) Pitch Envelope Generator 30
(2) Key Transpose 32
(3) Scaling 33
(4) Key Velocity 40
(5) Detune 42
(6) LFO 43
(7) Oscillator Mode 46

2. FUNCTION CONTROL MODE 48

(1) No. 1 Master Tune Adjust 48
(2) No. 2 Poly and Mono 49
(3) No. 3 Pitch Bend Range 49
(4) No. 4 Pitch Bend Step 49
(5) No. 5 Portamento Mode 50
(6) No. 6 Portamento and Glissando 50
(7) No. 7 Portamento Time 51
(8) No. 8 MIDI 51
(9) No. 9 Edit Recall 53
(10) No.10 Voice Initialize 53
(11) No.11 Cartridge Form 54
(12) No.12 No Operational Function 54
(13) No.13 No Operational Function 54
(14) No.14 Battery Check 54
(15) No.15 Save 54
(16) No.16 Load 54
(17) No.17 Wheel Range 55
(18) No.18 Wheel Pitch 55
(19) No.19 Wheel Amp 55
(20) No.20 Wheel EG Bias 56
(21) No.21 Setting Exercise 57

CHAPTER 3

1. SECRET OF EDIT

(1) Have a Concrete and Definite Purpose -
Wanting to Change the Sound in a Particular Way ... 60
(2) Decide what Data must be changed
in order to get the required sound 60
(3) Use of ON and OFF Functions of Operators or
Edit Compare Mode in order to facilitate editing .. 60

2. EXAMPLES OF ACTUAL EDITING 60

(1) INT 20. CLAV 1 60

(2) INT 30. VOICE 1 61
(3) INT 2. BRASS 2 62
(4) INT 4. STRINGS 1 63
(5) INT 9. PIANO 2 65

3. CREATING SOUNDS IN INITIAL VOICE 66

(1) Electric Piano 66
(2) Brass 72
(3) String Sounds 75
(4) Organ 77
(5) Cowbell 79
(6) Synthesizer Drum 80

4. VARIOUS KINDS OF SOUNDS 80

(1) Kawaii ne (Cute) 80
(2) Glass Voice 81
(3) 3-Split 82
(4) Synth Lead 82
(5) 5th Synth 1 83
(6) 5th Synth 2 83
(7) Gori Gori (Hurdy Gurdy) 83
(8) Bakuhatsu (Explosion) 84
(9) Aki no yoru (Autumn Night 1) 84
(10) Aki no yoru (Autumn Night 2) 84
(11) Dogs 85
(12) Konomama 86
(13) 1999 ... end 86
(14) Bunretsu (Break-up) 87

1. INFORMATION CONCERNING HARDWARE 90
2. SOLUTION TO MIS-SETTING 95
3. REMOTE KEYBOARD KX 1 96
4. ENHANCED USE OF DX BY MIDI TERMINAL 97
5. INTERNAL VOICE DATA LIST FOR INTERNATIONAL VERSION 99
6. USA VERSION 112

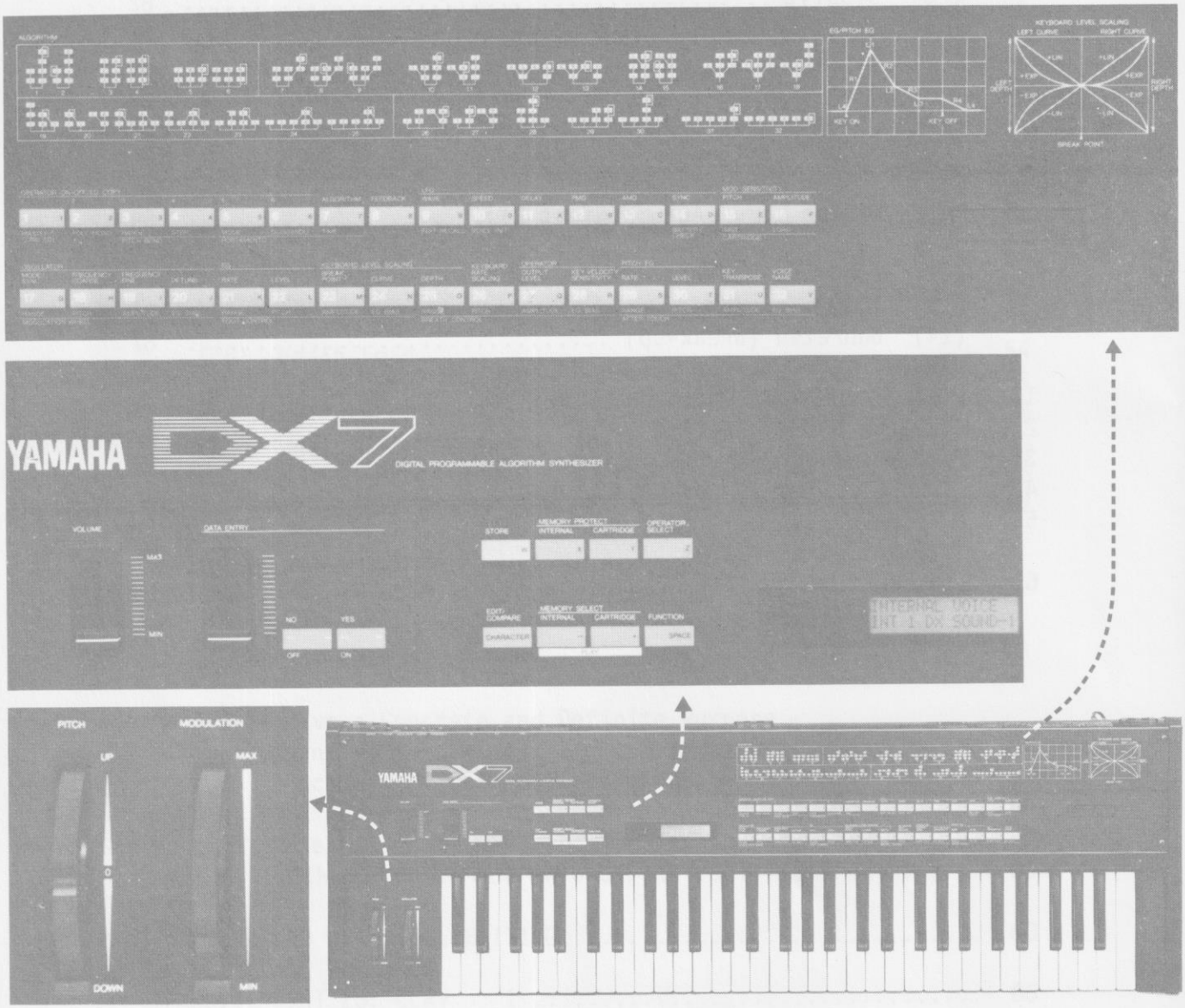
PREFACE

This manual, describing the theory and operation of the YAMAHA DX-7 DIGITAL SYNTHESIZER, should be used while actually operating the synthesizer.

Chapter 1 describes the theory of elementary sound making on the DX-7. Those approaching the DX-7 for the first time should commence with this chapter.

Chapter 2 contains the functional explanations for more advanced sound making techniques as well as the operating methods. Owners who already have a basic knowledge of the DX-7 may omit Chapter 1 and commence with Chapter 2.

Chapter 3 describes procedures for editing and tone creation together with hardware knowledge of the DX-7.



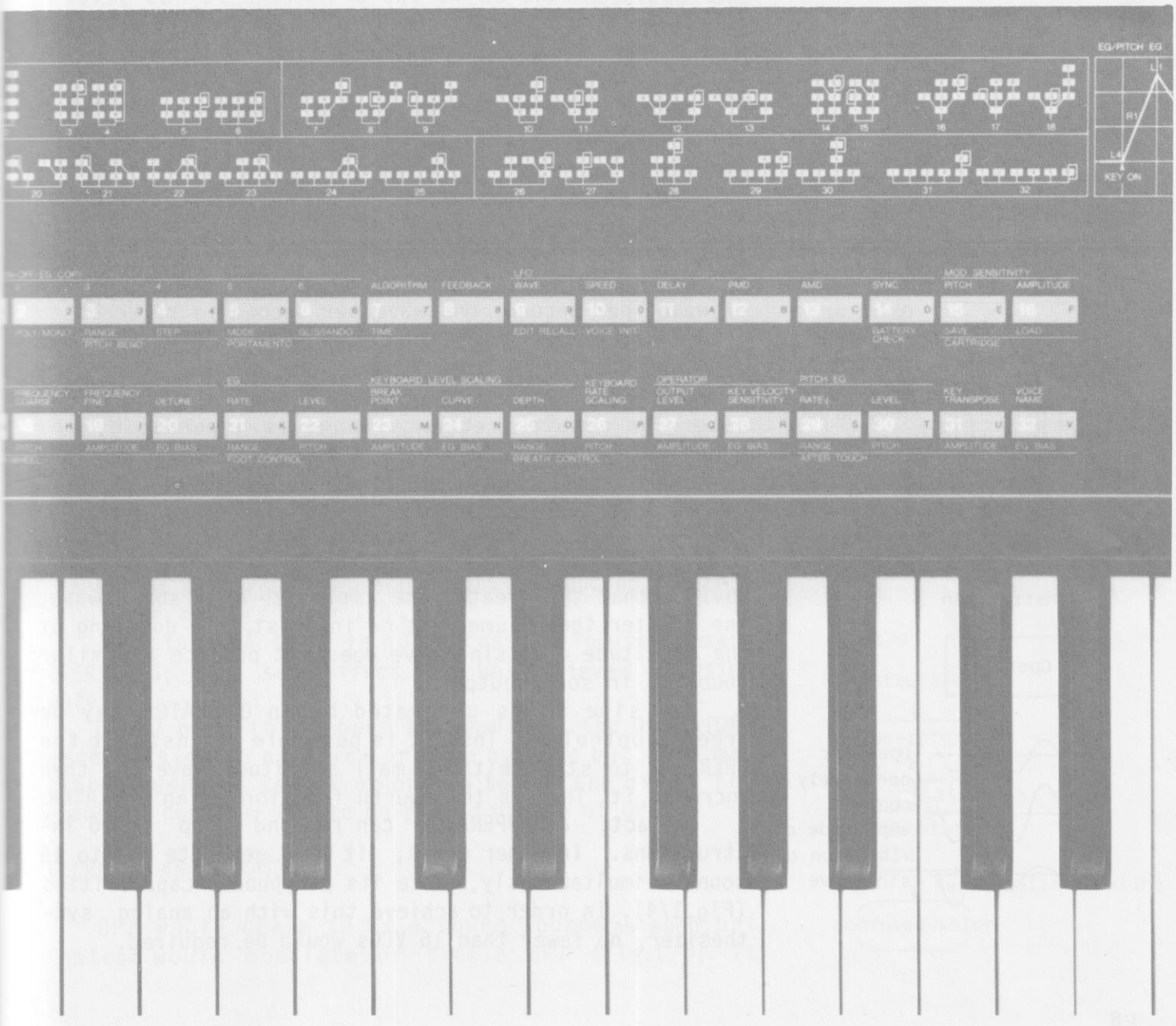
CHAPTER 1

(BASIC)

BASIC OPERATION OF THE DX

The first step to understanding the DX-7 is a thorough appreciation of the DX system.

Chapter 1 provides a breakdown of the basic system, while at the same time explaining the minimum knowledge necessary for editing, creating sounds and operating methods.



THE DX SYSTEM - FM SOUND SOURCE

A synthesizer is a 'device for composing'; thus something which is capable of creating sounds is a synthesizer.

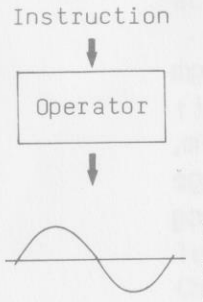
Generally a synthesizer generates sounds and controls pitch with a VCO, tone colour with a VCF and volume with a VCA.

The DX system uses a Frequency Modulation system which generates waveforms directly, differing from the VCO-VCF-VCA systems and is therefore much simpler in operation.

WHAT IS AN OPERATOR?

The heart of the DX is the OPERATOR. It has several functions, the first of which is to generate sine waves on command (Fig.1/1). This is the smooth, round sound of a tuning fork or flute.

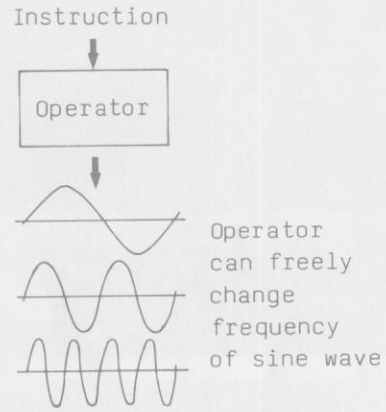
Fig.1/1
Operator's
1st function



The OPERATOR cannot of itself produce sounds other than sine waves unless it has the capacity for feedback (see later).

The second function of the OPERATOR is to generate the sine waves over a wide range of frequencies (Fig.1/2).

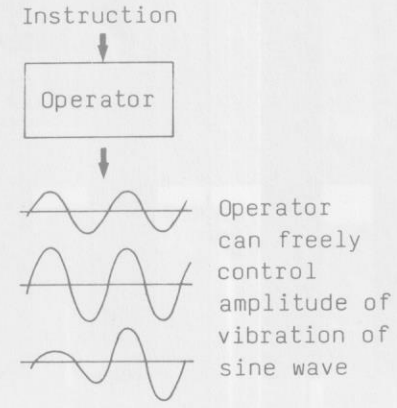
Fig.1/2
Operator's
2nd function



By way of explanation, 'frequency' means the number of waves per second; one wave per second is referred to as '1 Hertz' (Hz). With sound waves, the higher the frequency the higher the pitch of the note and conversely, the lower the frequency, the lower the pitch of the note. The usable frequency range is governed by the human ear and ranges from about 20 Hz to 20,000 Hz. This is known as the 'audible range' However, the OPERATOR can generate frequencies far beyond this audible range.

The third function is the ability to control the amplitude of the sine wave it generates (Fig.1/3). It is obvious that the greater the amplitude of a sound wave, the greater the volume. Out of interest, the doubling of the amplitude of a sine wave does not produce a similar doubling in sound output.

Fig.1/3
Operator's 3rd
function



The sine waves generated by an OPERATOR may be freely controlled. Thus it is possible to instruct the OPERATOR to start with a small amplitude wave and then increase it. This is the fourth function of an OPERATOR.

In fact, an OPERATOR can respond to up to 16 instructions. In other words, it can generate up to 16 sounds simultaneously, hence its polyphonic capabilities (Fig.1/4). In order to achieve this with an analog synthesizer, no fewer than 16 VCOs would be required.

Fig.1/4

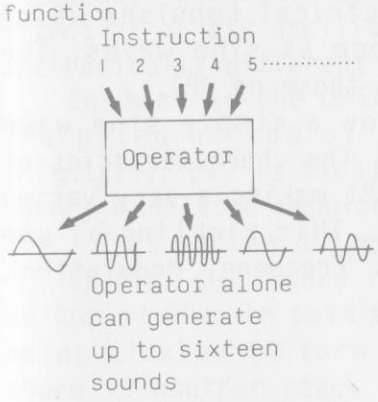


Fig.1/5

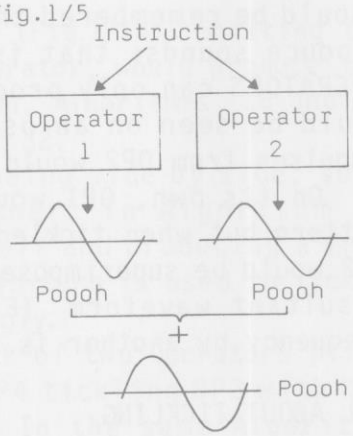


Fig.1/6

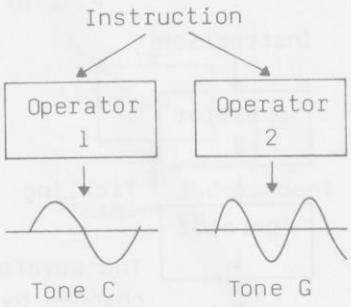


Fig.1/7

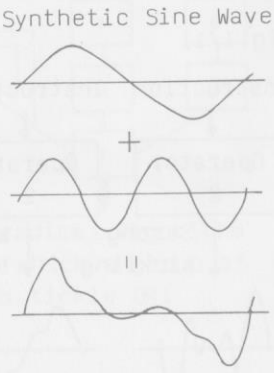
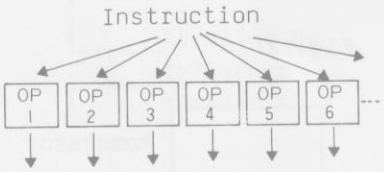
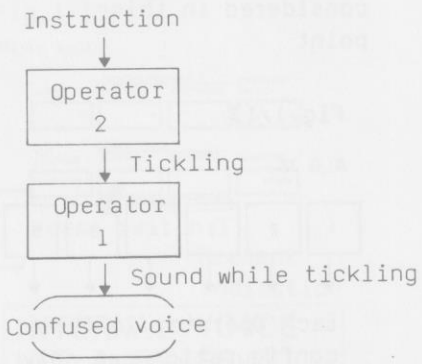


Fig.1/8



Synthetic Sine Wave can be made by putting dozens of Operators in a line sideways

Fig.1/9



TWO OPERATORS

Using one OPERATOR on its own means that there can be no variation of tone colour. To achieve this, another OPERATOR of the same type is required. They are named OP1 and OP2 respectively. However, since they each produce an identical sound - POOOH, when used together the resultant sound will still be the same (Fig.1/5). This is because the two OPERATORS have sounded simultaneously at the same frequency.

Since they are capable of generating different frequencies, one may be made to sound the note C for instance while the other sounds the note G (Fig.1/6). This is similar to an analog synthesizer having two VCOs. The result is a feeling of change of tone colour rather than a shift in pitch. This is called 'Sine Wave Synthetics'.

When sounds of different frequencies are added together, it results in varied waveforms producing different tone colours (Fig.1/7). Using only two OPERATORS would not be over-exciting, but using ten or 20 would produce a 'choral group' and they could be made to operate at different frequencies thus producing interesting tone colours (Fig.1/8).

In actual fact, it is not necessary to use so many OPERATORS; the same effect may be achieved by using only two.

Until now, it has been assumed that the OPERATORS were working in parallel or side by side but they may also be used in series or one on top of the other. For example, consider OP2 to be placed on top of OP1.

TICKLING AN OPERATOR

OP2 would cease to be a sound source as such, but instead would 'modulate' or 'tickle' OP1 (Fig.1/9). It

Fig.1/10

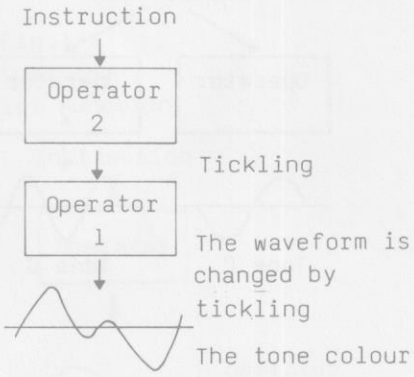


Fig.1/11

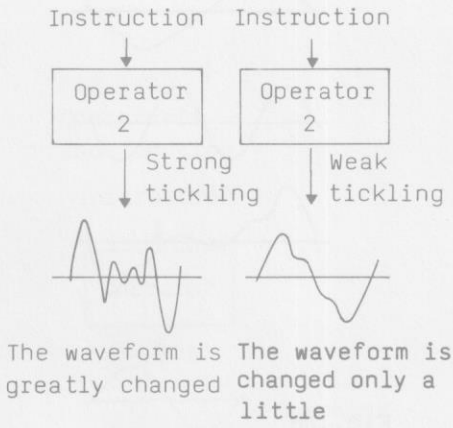


Fig.1/12

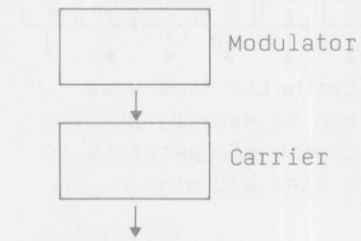
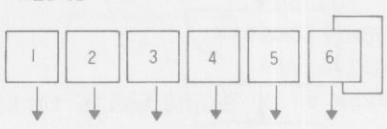


Fig.1/13



should be remembered that OPERATORS themselves do not produce sounds; that is the job of the loudspeakers. OPERATORS can only produce electrical impulses which could be seen on an oscilloscope as sine waves. The impulses from OP2 would 'tickle' those of OP1.

On its own, OP1 would follow a simple sine wave pattern but when tickled by OP2, the characteristics of OP2 would be superimposed onto OP1 making a very varied resultant waveform (Fig.1/10). This tickling of one frequency by another is known as 'Frequency Modulation'.

ALL ABOUT TICKLING

The scientific explanations concerning tickling would fill many a textbook. It is sufficient to follow the relationship between 'tickling' and 'being tickled' or between the tickler and the tickled. Also to be considered are the various types of tickling - strong and weak tickling, slow and fast tickling, etc. With an OPERATOR, the reaction is directly proportional to the strength of the tickling (Fig.1/11). The depth of variation of the waveform depends upon the strength of the tickling and the stronger the tickling, the more harmonics are present.

The tickler is called a 'Modulator' and the tickled OPERATOR is called the 'Carrier' (Fig.1/12). The uniqueness of the DX stems from the fact that the roles are not fixed; an Operator can be either a Modulator or a Carrier in relation to other Operators. The Modulator and the Carrier are said to be of the same 'origin'.

Since the origins are the same, it is possible to obtain a large range of waveforms but with the DX series, the range of possible sounds is almost limitless because the DX-9 has four Operators, the DX-7 six and the DX-1 has 12. When used together, a group of Operators is called an ALGORITHM. The DX-9 has eight of these groupings while the DX-7 has 32. Logically, since the DX-7 has six Operators, more than 32 groupings could be obtained, but any more than 32 would be superfluous.

ALGORITHM - GROUPS OF OPERATORS

Referring to the Algorithm diagrams printed on the instrument, it will be seen that the OPERATORS in ALGORITHM No.32 are lined up side by side (Fig.1/13). This is because none of them is being tickled by another. However, OP6 is shown differently from the others. This is because it is tickling itself! The line drawn from the bottom and back into the top indicates 'FEEDBACK'. In other words, OPs 1 through 5 generate only 'simple' sine wave impulses but OP6 generates a varied sine wave

because it is tickling itself (Fig.1/14). Shifting the frequency generated by each Operator, would produce the effect of a six oscillator organ. Algorithms 16 and 17 are radically different from No. 32.

Instead of the OPERATORS being side by side, some are piled on top of each other. In Algorithm 17 (Fig.1/15), OP2 is tickling itself and producing a frequency modulated impulse which in turn is used to tickle OP1. This it can do very strongly.

In Fig.1/16, there is a stack of two Operators piled on top of OP1. In this stack, OP4 tickling OP3 with OP1 being tickled in turn by OP3. In the same Algorithm there is another stack of two Operators, OP5 and OP6 on top of OP1 functioning in the same way as the previous stack. In short, OP1 is being tickled by a group of OPs.

Fig.1/14

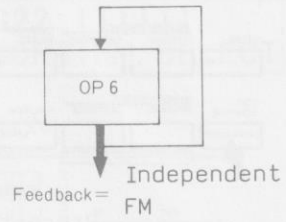
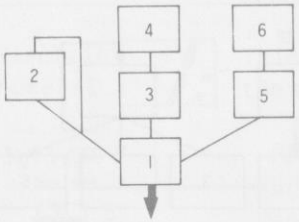
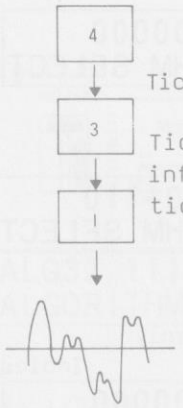


Fig.1/15



A radical Algorithm in which a group of OPs tickle OP1

Fig.1/16



The waveforms are greatly altered

Fig.1/17

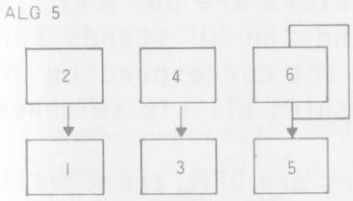


Fig.1/18

Indication

```
* YAMAHA DX7 *
* SYNTHESIZER *
```

In Algorithm 5, (Fig.1/17) there are three Carriers each with an attendant Modulator side by side in line. This will produce three tone colours simultaneously. OP1 & 2 give one tone colour, OP4 & 3 a second and OP6 & 5 a third.

It can be seen that this system in fact is far simpler than an analog synthesizer.

PLAY MODE ⟶ EDIT MODE

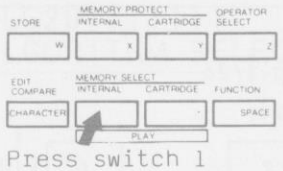
On switching on the power, the DX-7 introduces itself via the liquid crystal panel (Fig.1/18).

Before it can be played, the instrument must be put into PLAY MODE. In this mode, the tone colour can be selected by means of the 32 switches on the right hand side. It may well be that it is already in PLAY MODE. This would be so if it had been switched off while in that mode previously. Similarly, it would be in EDIT MODE if that had been how it was left when last switched off. It can happen that a setting will be cleared by turning off the power.

In order to play, INTERNAL under MEMORY SELECT must be pushed, and then a suitable number such as No.1 (Fig.1/19). The reason for this is because there is no cartridge inserted and it would be a useless exercise to push the CARTRIDGE button. The INTERNAL button puts on a preset sound.

Fig.1/19

PLAY MODE



Press switch 1

Present indication

```
INTERNAL VOICE
INT 1 BRASS 1
```

Fig.1/20

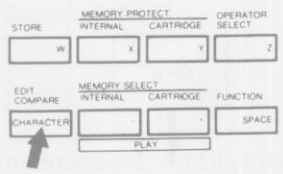


Fig.1/21

Present indication

```
ALG22 111111
ALGORITHM SELECT
```

Fig.1/22

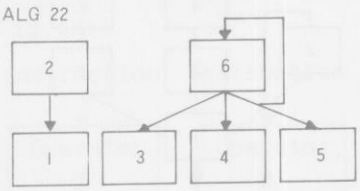


Fig.1/23

Indication

```
ALG22 000000
ALGORITHM SELECT
```

Fig.1/24

```
ALG23 101110
ALGORITHM SELECT
```

Fig.1/25
Operator 1 only

Indication

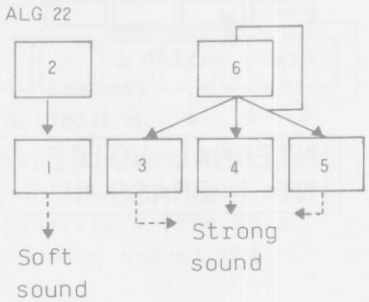
```
ALG22 100000
ALGORITHM SELECT
```

Operator 3 only

Indication

```
ALG22 001000
ALGORITHM SELECT
```

Fig.1/26



The next stage is to check the data which goes into producing a sound such as brass obtained from INT.1 and then to change the tone colour.

To do this, it is necessary to change over to EDIT MODE by pressing the switch so marked (Fig.1/20).

Next, by pressing switch No.7 the Indicator will show ALGORITHM SELECT (Fig.1/21). In the EDIT MODE, the 32 switches on the right become the selector switches used to edit the contents of MEMORY. The contents are listed in the violet coloured printing above the switches. In this mode ALGORITHM may be selected. The ALG 22 shown on the liquid crystal indicator means that the brass sound is generated by ALGORITHM 22 (Fig.1/22).

ON/OFF OPERATOR

The figures 111111 on the right hand side of the Indicator show that all the Operators are ON. A '1' is computer terminology for 'ON' and the '0' stands for 'OFF'. With switches 1 through 6, the corresponding OP may be turned either ON or OFF. Pushing all six switches will show 000000 (Fig.1/23).
Naturally, since all the Operators are OFF, there will be no sound if the keyboard is played.

Switching on 1,3,4 and 5 will turn ON the corresponding OPs. Now the Indicator will show 101110 (Fig.1/24). Playing the keyboard will produce a sombre sound with this selection. This is because OPs2 and 6 are the Modulators for this particular Algorithm (ALG 22) and both are OFF. Hence the shallow and uninteresting sound because the tone colour made with these OPs is just a collection of bare sine waves without any Frequency Modulation. Turning OFF each OP except OP1 produces a dark tone colour (Fig.1/25). This is now an unmodified sine wave except for a small amount of vibrato produced because of its relation to other settings. OPs 1,3,4 and 5 are the same.

The way it is set now, OP1 seems to be set one octave lower than the others. Listening in turn to the combinations OP2 - OP1, OP6 - OP3, OP6 - OP4 and OP6 - OP5, OP2 - OP1 come out as a comparatively soft brass while the other combinations are all the same, a strong bright brass sound. This shows the effect a Modulator has (Fig. 1/26).

CHANGING AN ALGORITHM BY DATA ENTRY

By now, the relationship between Modulator and Carrier should be thoroughly understood.

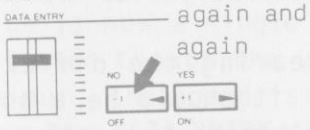
Turn all the Operator switches ON (Fig.1/27). Now change the Algorithm. To change Memory Data, it is

necessary to use the DATA ENTRY section. It is located to the right of the Volume Slider. The data is changed by using the +1 or -1 switches which select either the next or preceding Algorithm, or the slider may be used for quicker changes if it is desired to move forward or back by more than one step. Press +1 once (Fig.1/28). The Indicator will now change to ALG 23 and a spot will light up on the lower side of the numeral (Fig.1/29). The spot indicates that there has been a change in the Memory Data and that the EDIT MODE was actually entered.

Pressing down and holding any key whilst at the same time pushing +1 over and over will cause the tone colour to change rapidly corresponding to the change in Algorithm (Fig.1/30). Using the same procedure but with -1 will reverse the operation (Fig.1/31).

It is possible to move the slider up and down while actually playing (Fig.1/32) producing a rapid change through all 32 tone colours.

Fig.1/31

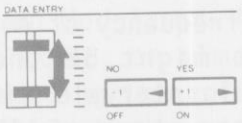


Press again and again

Indication

ALG17 111111
ALGORITHM SELECT

Fig.1/32



Move the slider up and down rapidly while playing keyboard

The situation can arise where the slider is at the top but the Algorithm is at a number other than 32. Set ALG 32 again with the slider (Fig.1/33). By using the -1 switch, the Algorithm number will come down, say, to No.20 (Fig.1/34). It is possible however to return to ALG 32 using the slider. All that is necessary is to move the slider back a short way and then return it to the top (Fig.1/35). When the slider is moved, previous data is cleared.

To check the type of Algorithm used to make the INTERNAL VOICE sounds, call Free Memory in PLAY MODE and switch to EDIT MODE. The role of each Operator may be studied by turning each one ON and OFF independently.

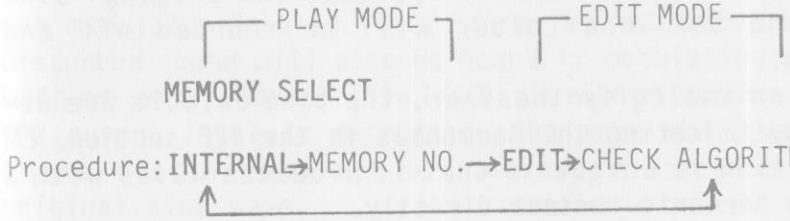


Fig.1/27

Indication

ALG22 111111
ALGORITHM SELECT

Fig.1/28

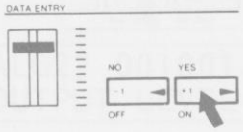


Fig.1/29

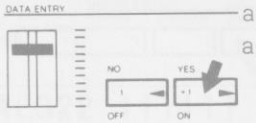
Indication

ALG23 111111
ALGORITHM SELECT

Electric numeral

This indicates the edit state

Fig.1/30

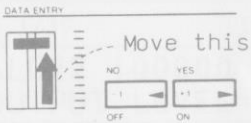


Press again and again

Indication

ALG32 111111
ALGORITHM SELECT

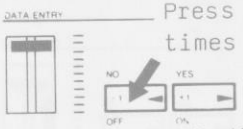
Fig.1/33



Indication

ALG32 111111
ALGORITHM SELECT

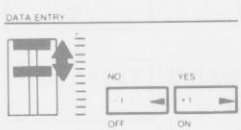
Fig.1/34



Indication

ALG20 111111
ALGORITHM SELECT

Fig.1/35



The slider displays previous data by these movements

WAVEFORMS AND HARMONICS

Musical interval, tone colour and sound volume are the three basic elements of sound. However, among these three, the tone colour is decided by the generated waveform. When the waveform is decided, then the tone colour is decided. What decides the waveform is harmonic content. This manual repeats the phrase 'harmonic frequency' and it is the key word in understanding all synthesizers, not only the DX-7.

Harmonics are contained in most sounds. For example, touching the lowest key on the piano, bottom A, would produce the note A corresponding to it. But the A contains many tones whose pitch is higher than the tone which may be heard, some by octaves, some by fifths and some by fourths. The group of these musical intervals is called the 'Harmonics' or harmonic composition of the original tone. The harmonic with double the frequency is called the 'octave', etc. Therefore when the note A4 (middle A) is played on the piano, frequencies of 880Hz, 1320Hz and 1760Hz are heard simultaneously with the original frequency of 440Hz.

It might be thought that hearing the different musical intervals simultaneously, it should be a sound like the chord of 'A' but it doesn't work that way.

If each harmonic is examined, it will be found to be a sine wave and a sine wave characteristically mixes easily with the frequencies themselves and the waveforms change rapidly upon mixing with it. Add the sine waves of the harmonic frequencies into the original waveform and examine the integer times. The original frequency remains as it was but the waveforms will be transformed sine waves. Adding a higher harmonic which is of a lower sound volume will produce a sawtooth waveform; adding the odd numbered harmonics will produce a square wave. The tone colours produced by these methods are referred to as the Synthetic Sine Wave System and a Hammond organ is a typical example. (In the DX, the same sound can be produced by using ALG 32). The waveforms and tones are decided by the harmonic content (how the sine waves of various frequencies are combined).

Generally, when larger, higher order harmonics are present, the tone colour will be a screeching sound and conversely, in cases where the harmonics are of a lower order, the waveforms will approach the original sine wave and the tone colour will be rounded off and clouded.

In an analog synthesizer, the tone colours are decided by filtering the harmonics in the VCF section. FM modulation is unique in that it produces waves with a certain harmonic content directly.

(BRASS 1 OF INT.1 should be recalled now and the mode changed to the EDIT MODE).

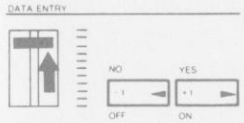
OUTPUT LEVEL

Control of the Amplitude of Wave Vibration (sound volume for a Carrier and tickling strength for a Modulator) is achieved by pushing the switch marked 'OUTPUT LEVEL' which is switch No.27 under EDIT MODE. The words 'OUTPUT LEVEL' will appear in the Indicator (Fig.1/36).

Where OP1 appears after the 111111 indicates that this is the Operator which is generating this data. If the OUTPUT LEVEL is changed, the data generated by each Operator is put in Operator by Operator in numerical order, one after the other. The number of the Operator is changed by pushing the OPERATOR SELECT switch (Fig.1/37). Thus the data for each Operator may be checked. (OP1 is 98, OP2 is 86, OP3 is 99, OP4 is 99, OP5 is 99 and OP6 is 82). Pushing the switch once more returns it to OP1 (Fig.1/38).

The setting range for the OUTPUT LEVEL is from 0 to 99 or 100 steps. Turn off all the Operators except OP1 which is now a single Carrier with no Modulator. Notice that even though the volume is set at 98, or almost at maximum, the sound is quite low. Reducing the volume by using the DATA ENTRY slider and striking the keys harder will show that the sound almost disappears at about 50 (Fig.1/39). However, unless the volume is set at 0, there is some output even though it may not be audible.

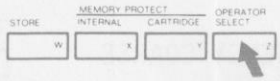
Fig.1/40



ALG22 100000 OP1
OUTPUT LEVEL=99

Fig.1/41

OP 2 ON



Indication

ALG22 110000 OP2
OUTPUT LEVEL=86

Return the OUTPUT LEVEL to 99 (Fig.1/40) and turn OP2 ON. Select its data using the OPERATOR SELECT switch (Fig.1/41). It should be noted that an Operator must be turned ON for its data to be read.

If the OUTPUT LEVEL of OP2, now standing at 86 (Fig.1/42) is raised to 99, the sound becomes very disturbed. This produces maximum modulation when only one modulator is used. This is called 'maximum tickling' Disturbed sound will also be heard if modulation is used without any feedback (Fig.1/43). In other words, as the OP2 output level is decreased, the modulating wave becomes flatter and the OP1 waveform approaches the original sine wave.

Fig.1/36 Indication

ALG22 001001
ALGORITHM SELECT

Indication

ALG22 001001 OP
OUTPUT LEVEL=

Fig.1/37

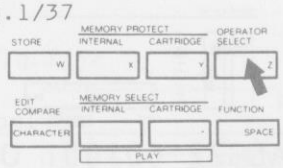
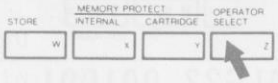
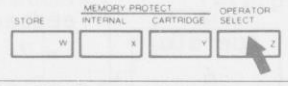


Fig.1/38

ALG22 111111 OP1
OUTPUT LEVEL=98



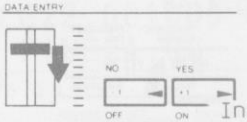
ALG22 111111 OP2
OUTPUT LEVEL=86



ALG22 111111 OP3
OUTPUT LEVEL=99

Fig.1/39 Indication

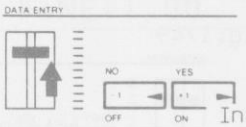
ALG22 100000 OP1
OUTPUT LEVEL=98



Indication

ALG22 100000 OP1
OUTPUT LEVEL=50

Fig.1/42



Indication

ALG22 110000 OP2
OUTPUT LEVEL=99

Fig.1/43

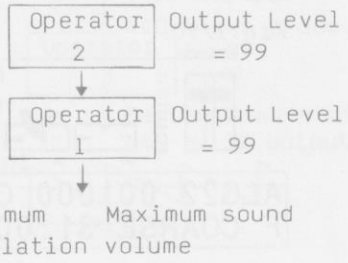


Fig.1/44

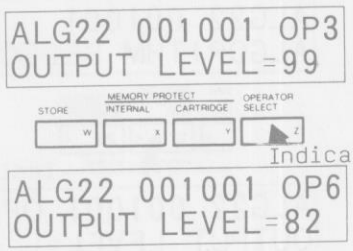


Fig.1/45

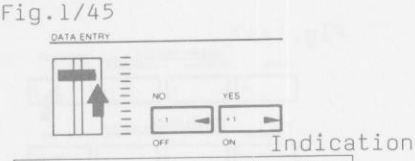


Fig.1/46

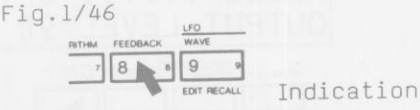


Fig.1/47

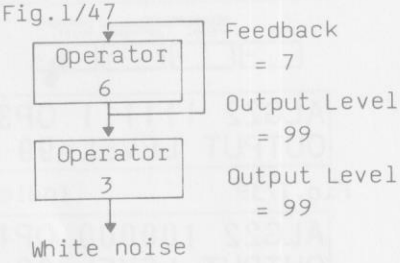
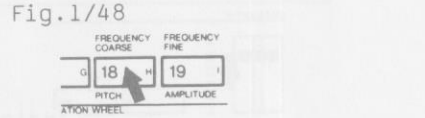


Fig.1/48



OP6 is OFF

Fig.1/49

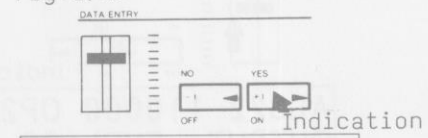
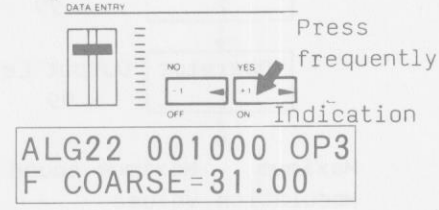


Fig.1/50



FEEDBACK AND OUTPUT LEVEL

This next part will show how the FEEDBACK FUNCTION works with the Modulator.

Turn OFF OP1 and OP2 and turn ON OP3 and OP6. Set the OUTPUT LEVEL of OP3 at 99. This will not produce distortion as it is a Carrier.

The reading of 86 for OP6 shows that its output level is lower than OP2 (Fig.1/44), but because of FEEDBACK, the combination of OP6 and OP3 has a steadier tone. To understand it even further, push the output level of OP6 up to 99 (Fig.1/45). The result is white noise.

Now press feedback switch No.8. It shows that the setting is 7. This is because the eight steps are numbered from 0 to 7 (Fig.1/46). At this setting, an independent frequency modulating wave at maximum strength is generated which tickles OPs 3,4 and 5. When this is used in conjunction with OP2 and 1 or OP6 and 3, the sound will be radically changed. When white noise is created on the DX-7, the Feedback Modulator is put in the Carrier when feedback is set at 7 and the output level is at 99 (Fig.1/47).

In addition to white noise, there are other sounds because of the use of the pre-made OP6 sound envelope.

Feedback is important in other ways. For instance, it is required to get the rustling sound of the upper frequencies of stringed instruments. However, it is to be remembered that feedback and output level must be delicately adjusted in tandem in order to avoid 'disrupted' sound.

FREQUENCY COARSE

The next thing to be considered is the manner in which the tone colour will be influenced by the frequency generated by each Operator.

Push switch No.18, the Frequency Coarse switch, and look at the data for OP3. Turn OFF OP6 (Fig.1/48).

The word 'COARSE' means just what it says - coarse rather than fine or delicate - coarse tuning. The 1.00 means 'base frequency'. For example, if the third A from the left hand end of the keyboard (A3) is played, the frequency would be 440 Hz. Now press the +1 switch DATA ENTRY and play A3 (Fig.1/49).

F COARSE has now changed to 2.00 and the pitch has moved up one octave. Pushing the +1 again will take it up to 3.00 and the pitch will go up two octaves. The frequency increases as a multiple of the number displayed (Fig.1/50). It is possible to get a maximum of 31.00 and A3 would become 440 Hz x 31 = 13,640. Similarly, A4

would become 27,280 Hz, i.e, way beyond the upper limit of the audible range. Conversely, if F COARSE = 0.50, A3 would become 220 Hz.

FREQUENCY FINE

Set F COARSE back to 1.00. Every time the F FINE switch is pushed, the frequency is changed by 1/100 of the base frequency (Fig.1/51). Pushing the +1 switch repeatedly on A3 (Fig.1/52) will cause the pitch to go up gradually.

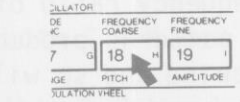
The pitch is actually moving in steps (Fig.1/53). With the A3 key pressed, every time the +1 switch is pushed, the frequency increases by 440/100 Hz. It is therefore going from 440 Hz to 444.4 to 448.8 to 453.2 etc. The Indicator would meanwhile display 1.00, 1.01, 1.02, 1.03 etc. If F COARSE is set to 2.00 instead of 1.00, it would then go from 2.00 to 2.02 to 2.04 to 2.06 etc. If F COARSE were set to 11 for instance, then it would go from 11.00 to 11.11 to 11.22 to 11.33 etc.

MODULATOR FREQUENCY

Since there has been only a variation of pitch above, it follows that the F COARSE and F FINE have been affecting the Carrier alone; but the Modulator also has F COARSE and F Fine controls.

Set the OP3/F FINE back to 1.00 and turn ON OP6 and use the OPERATOR SELECT FUNCTION to switch over to OP6 (Fig.1/54). Push switch 18 F COARSE (Fig.1/55).

Fig.1/55



Indication

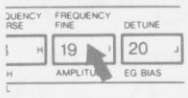
```
ALG22 001001 OP6
F COARSE=1.00
```

Since the F COARSE of OP6 is also at 1.00, it would seem logical to expect OP6 to generate a frequency of 440 Hz if A3 is played. But this is not so because OP6 is a modulator. It should generate a modulating wave with a frequency of 440 Hz. In other words, with A3 being played, it would tickle OP3, which is oscillating at 440 Hz, 440 times a second. This is impossible for the human ear to detect.

In this case where the frequency of the Carrier wave is equal to the frequency of the Modulator, it is expressed as a ratio of 1:1. When the ratio is 1:1 and the output level of the modulator is suitable, the Carrier waveform closely approximates a sawtooth waveform (Fig.1/56). This is the waveform used to duplicate

Fig.1/51 Indication

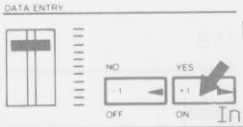
```
ALG22 001000 OP3
F COARSE=1.00
```



Indication

```
ALG22 001000 OP3
F FINE=1.00
```

Fig.1/52

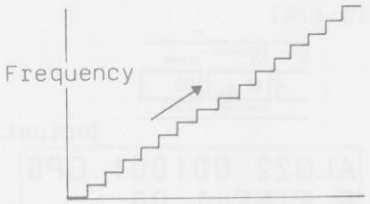


Press frequently

Indication

```
ALG22 001000 OP3
F FINE=1.01
```

Fig.1/53

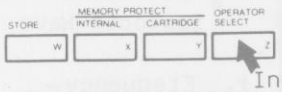


Musical interval changes step-wise

Fig.1/54 Indication

```
ALG22 001000 OP3
F FINE=1.00
```

OP6 is ON



Indication

```
ALG22 001001 OP6
F FINE=1.00
```

Fig.1/56

- When A3 Key is pressed

Operator 6 | F COARSE =1.00

This tickles 440 times a sec.

Operator 3 | F FINE =1.00

Sawtooth wave of 440 Hz is output

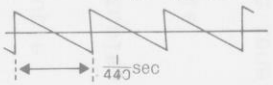
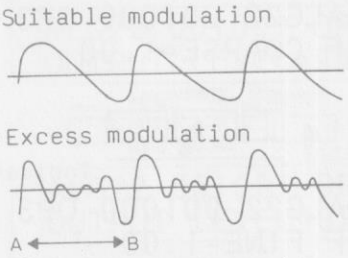
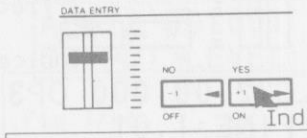


Fig.1/57



Zig-zag per one cycle of wave (between A & B) is increased

Fig.1/58



Indication

ALG22 001001 OP6
F COARSE=2.00

Fig.1/61

Indication

ALG22 001001 OP6
F FINE=1.00

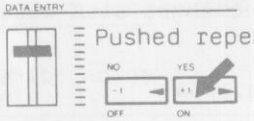
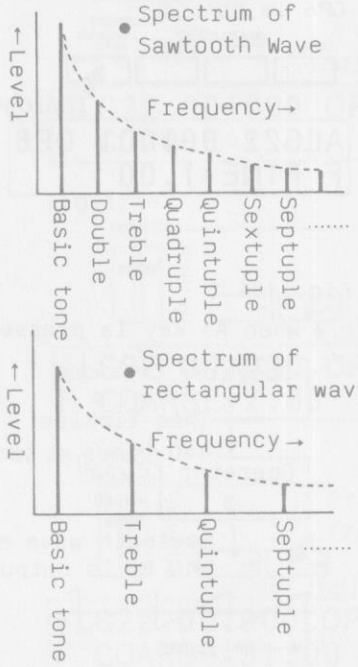


Fig.1/62



brass and strings on an analog synthesizer. It is hard and bright with a high harmonic content.

The expression 'if the modulator is suitable' means that the modulator output must not be too deep as even with a ratio at 1:1, a disrupted wave will occur (Fig.1/57).

FREQUENCY RATIO OF MODULATOR TO CARRIER

Setting the Modulator frequency to Carrier frequency ratio to 2:1, i.e. setting F COARSE for OP6 to 2.00 (Fig.1/58) produces a woodwind sound. In general it may be said that a frequency ratio of 2:1 produces a square waveform (Fig.1/59). Of course the Modulator output level has some bearing on this. Since a square wave has only odd harmonics, the tone colour is more rounded than as for a sawtooth waveform. If the Modulator F COARSE is raised, changing the frequency ratio of the Modulator to Carrier, then the wave patterns produced by the Carrier will go on changing likewise and so will the tone colour (Fig.1/60). When the frequency ratio of Modulator to Carrier is increased, the higher harmonics also increase. A sound similar to the DX's INTERNAL 11 tone for ELECTRIC PIANO will result.

Fig.1/59

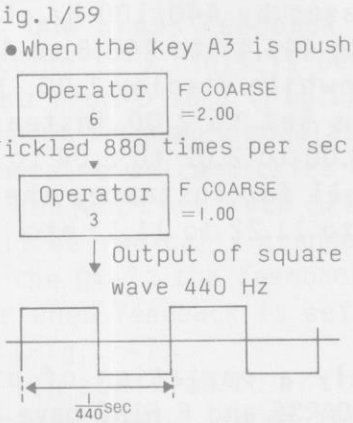
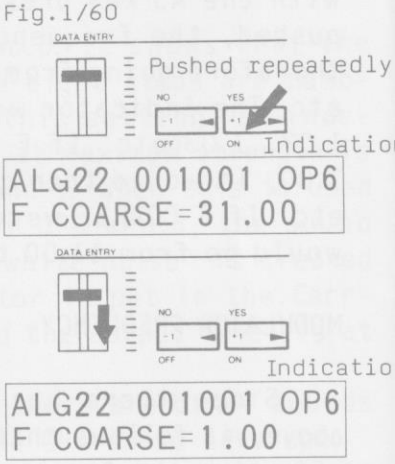


Fig.1/60



Using F FINE instead of F COARSE (Fig.1/61) produces some unusual effects. When the frequency ratio is not based on integer values, unusual harmonics appear which do not coincide with the fundamental tone. Both the rectangular and sawtooth waveforms include, basically, only integer harmonics of the fundamental tone (Fig.1/62). The sawtooth is the sum of the sine wave of the fundamental tone and the sine waves of the frequency multiplied by integers such as the sine wave of the fundamental plus its octaves. Although not all harmonics harmonize with the fundamental tone, the ones that do predominate. That is why the sawtooth has a clear musical tone.

But when the tone is multiplied by 1.3 or 2.57 for example, there is no clear musical tone because they can never harmonize with the fundamental tone.

The DX is able to reproduce these sounds very easily by a fine adjustment of the frequency of the Modulator. If the OUTPUT LEVEL of the Modulator is appropriate, non-random tones may be obtained. TUBULAR BELLS of INTERNAL 26, the STEEL DRUM of INTERNAL 27 and the TIMPANI of INTERNAL 28 are good examples of this. This method may be used for other sounds such as a flute and the delicately biased tone colour of a hard-blown horn.

It is possible to determine the frequency ratio used in the INTERNAL VOICE by examining the F COARSE of each Operator.

INT. 1 BRASS 1) All the ratio values M:C of
) F COARSE of the Modulator and
INT. 2 BRASS 2) the Carrier are 1

INT.11 E PIANO 1) Utilising the larger
INT.15 BASS 1) settings of M:C

FREQUENCY RATIOS OF THE CARRIER AND MODULATOR

Examples of the type of Harmonic Component obtainable by the ratios of the Carrier and Modulator.
C = n x M (C = Carrier Freq. M = Modulator Freq.
n = the integer number over 0).

Example 1. When both C & M are 440 Hz

n = 0 1+0x1 = 1 1-0x1 = 1
n = 1 1+1x1 = 2 1-1x1 = 0
n = 2 1+2x1 = 3 1-2x1 =-1
n = 3 1+3x1 = 4 1-3x1 =-2
n = 4 1+4x1 = 5 1-4x1 =-3

These answers show how many multiplied harmonics may be obtained from this FM modulation of C:M = 1:1.

When the answers are arranged in numerical sequence, (those of a negative order being ignored), it will show the harmonics of multiplied integer of 1.

This is the order of sawtooth but this cannot always be obtained if C:M is as 1:1 because this formula has nothing to do with the level of each harmonic. When the level of harmonic is different, even if the order of harmonics are the same, the waveform will be different. Thus sawtooth waveform will only be achieved if the OUTPUT LEVEL SETTING is correct at C:M = 1:1.

Example 2. When C:M is as 1:2

n = 0 1+0x2 = 1 1-0x2 = 1
n = 1 1+1x2 = 3 1-1x2 =-1
n = 2 1+2x2 = 5 1-2x2 =-3
n = 3 1+3x2 = 7 1-3x2 =-5

From these it can be seen that only odd harmonics may be obtained. Thus, if the OUTPUT LEVEL SETTING of M is correct, rectangular waves may be achieved.

Example 3. When C:M is as 1:10

n = 0 1+0x10 = 1 1-0x10 = 1
n = 1 1+1x10 = 11 1-1x10 = -9
n = 2 1+2x10 = 21 1-2x10 =-19

In this example, the harmonic coming out next to the fundamental tone (basic frequency component) is situated very far from the fundamental tone. The separation between the fundamental tone and the harmonic is clear in the result of the calculation in the case of modulation by high frequency.

Example 4. When C:M is as 1:1.23

n = 0 1+0x1.23 = 1 1-0x1.23 = 1
n = 1 1+1x1.23 = 2.23 1-1x1.23 =-0.23
n = 2 1+2x1.23 = 3.46 1-2x1.23 =-1.46

The fundamental tone always comes out such that n always starts from 0. For instance, when M = 1.25 or 1.5 and n = 4 or 8, the result is integers. Therefore when M is a prime number, there are more harmonics of integers and strong feelings of pitch.

INT. 26 TUB BELL) Settings where M:C
INT. 27 STEEL DRUM) is not integer
INT. 28 TIMPANI) will be found.

INT. 3 BRASS 3) Settings where M:C is not integer
) (to achieve delicate tone colour)
INT. 24 FLUTE 1) will be found.

ENVELOPE GENERATOR

Three basic points concerning the operation of the DX should have been grasped by now:

(1) What an Algorithm is and what it is used for;
(2) About OUTPUT LEVEL of the Carrier and Modulator (FEEDBACK included) and their effects on sounds created by the DX;
(3) The interrelation between Carrier and Modulator oscillation frequencies.

Adding the knowledge of how to make an ENVELOPE to the understanding of how to determine a tone colour results in the ability to make some simple sounds on the DX.

The ENVELOPE GENERATOR (EG) is a device that generates the sound ENVELOPE. It controls the pattern of tone volume and tone colour range in relation to time when a key is played and released. The same applies to the DX. By setting the EG, free control of the tone colour and volume is possible. The DX has its own PITCH EG inside which changes musical interval in relation to time.

The EG of the Carrier controls volume in relation to time.

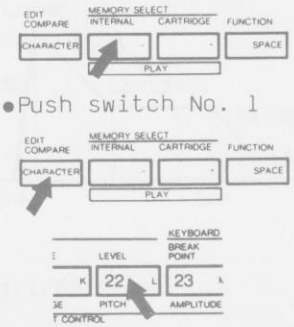
Select BRASS 1 by means of PLAY MODE, switch it to EDIT M, push switch 22 for EG LEVEL and then turn OFF all the Operators except OP1 (Fig. 1/63). The Indicator should now show EG LEVEL 1 = 99. Push switch 22 again and it should now show EG LEVEL 2; push the switch again and it will read LEVEL 3 and yet again for LEVEL 4 thus giving four LEVELS. By pushing switch 21 on the left, it will show that there are four RATES as well from 1 to 4. This means that there are eight settings - four LEVELS and four RATES - to be made to produce an ENVELOPE. Although this is double the number normally made on an analog synthesizer (ATTACK TIME, DECAY TIME, SUSTAIN LEVEL and RELEASE TIME) it is possible to make far more delicate and complicated ENVELOPES on the DX including effects which are impossible with an ADSR circuit.

LEVEL 1 is the maximum volume the tone reaches after the key is played; LEVEL 2 is that to which it drops after reaching the peak; LEVEL 3 is the level it sustains at after that, while the key is held (this corresponds to the Sustain Level of ADSR). LEVEL 4 is a new feature being the level to which the tone drops after the key is released. The sound set by LEVEL 4 is sustained even after the key is released. Each of these levels may be incremented through scales of 100, from 0 to 99.

Remember that RATE refers to SPEED and not TIME. RATE 1 is the speed at which the volume reaches LEVEL 1 after the key is pressed; RATE 2 is the speed at which it reaches LEVEL 2 from LEVEL 1; RATE 3 is the speed from LEVEL 2 to LEVEL 3; RATE 4 is the speed it reaches LEVEL 4 after the finger is removed from the key. The RATES are similarly incremented through 100 steps, 0 to 99, with 99 being the top speed (Fig. 1/64).

Bearing these points in mind, the ENVELOPE data for OP1 would be written: LEVEL 1 = 99; LEVEL 2 = 98; LEVEL 3 = 98; LEVEL 4 = 0; RATE 1 = 77; RATE 2 = 36; RATE 3 = 41; RATE 4 = 71. The diagram shows the ENVELOPE to be almost a straight line and although a speed of 77 may have little or no meaning, it is only one step.

Fig.1/63



●Push switch No. 1

●Set only OP1 to ON

Indication

ALG22 100000 OP1
EG LEVEL 1=99

* A=ATTACK TIME Time which Level takes to be maximum after the key is ON.
D=DECAY TIME Time which Level dwindles down from maximum to Sustain Level.
S=SUSTAIN LEVEL Level which is sustained while the key is ON.
R=RELEASE TIME Time which Level takes to be 0 after the key is OFF.

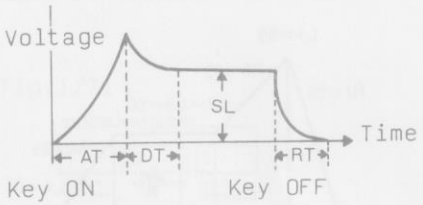


Fig.1/64a

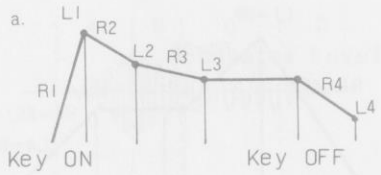
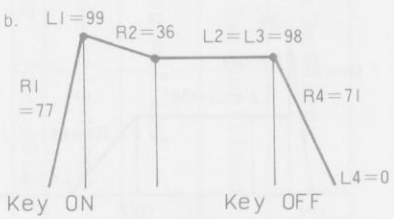


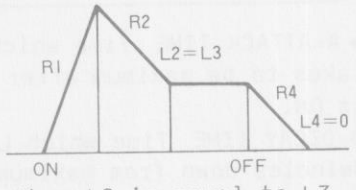
Fig.1/64b



A speed of 77 is somewhat fast and so the volume reaches LEVEL 1 almost the instant the key is pressed. Because of this difficulty in comprehending SPEED there is a tendency to make ENVELOPES in multiples of ten - 10, 20, 30, 50, 80, etc, but after some sort of feeling is achieved, then multiples of five might be tried - 5, 10, 15, 30, 75, etc. In the beginning it might be better to try setting just four parameters as for ADSR rather than all eight.

SIMPLIFIED EG

Fig.1/65a

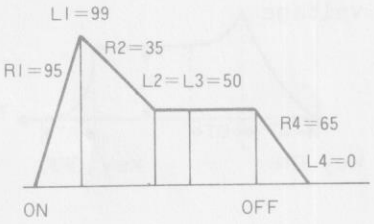


When L2 is equal to L3 there can be no R3

A simplified way of making an EG is to keep LEVEL 1 at 99, say, and LEVEL 4 at 0. Then set LEVELS 2 and 3 at the same value (Fig.1/65a). This way, in effect, only one LEVEL is being changed since LEVELS 2 and 3 are set the same. This is similar to ADSR since only one LEVEL is set there (Sustain Level).

Keeping within these bounds, RATE 1 may be equated with ATTACK TIME, RATE 2 with DECAY TIME and RATE 4 with RELEASE TIME (RATE 3 may be ignored since it is the same as RATE 2). Since this is a simplification, many of the possibilities are being ignored but it is easier to understand in this way. Later other parameters may be introduced.

Fig.1/65b

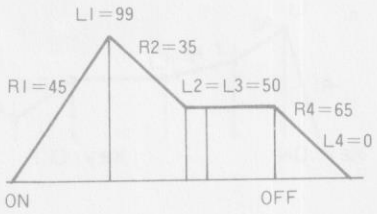


Set the following:

LEVEL 1 = 99	RATE 1 = 95
LEVEL 2 = 50	RATE 2 = 35
LEVEL 3 = 50	RATE 3 = 99
LEVEL 4 = 0	RATE 4 = 65

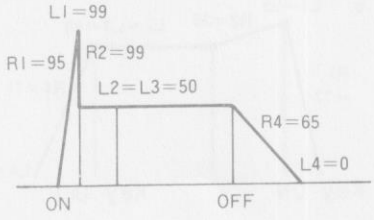
The ENVELOPE (Fig.1/65b) causes the tone to rise and fall back very quickly producing a tone similar to the PIANO.

Fig.1/66



CHANGING THE EG DATA

Fig.1/67



First change RATE 1. As it is now, the tone reaches peak volume almost as soon as the key is pressed as 95 represents almost top speed. Slow it down to half that rate, namely 45, (Fig 1/66) and notice that the volume develops very slowly because the ATTACK TIME has been lengthened. In theory, if RATE 1 were equal to 0, there would be no sound but in practice there would be, but it takes a very long time to develop. It would take about 39 seconds for the sound to reach full volume. It would be impossible to do this on an analog synthesizer since the EG makes use of the discharge of a capacitor.

Now set RATE 1 back to 95 and move RATE 2 from 35 to 99 (Fig.1/67). At these settings, nothing will be heard because with RATE 2 and RATE 1 set at 99, the sound reaches its peak and then returns to zero instantaneously. In fact, set at 50, LEVELS 2 and 3 are giving some sound but when talking about OUTPUT LEVELS, at this setting, the sound is below the normal hearing threshold.

Now set RATE 2 back to 35 again (Fig.1/68). Rate 3 is set at 99 but has no effect on the sound. Set RATE 4 at 50 and note the effect. Since the sound cuts rather badly here, it might be better to set it lower, say at 45. When it was set 65 previously, it produced an effect with a sharpness similar to a piano.

This EG is analagous to EG SET on VCA on an analog synthesizer. To decide the Carrier's EG SET is to make the amplitude of the Carrier's sine wave change in width along a certain pattern as a function of time (Fig.1/69). Thinking of it in this way enables a grasp of the Modulator's EG to be obtained more readily.

Fig.1/68

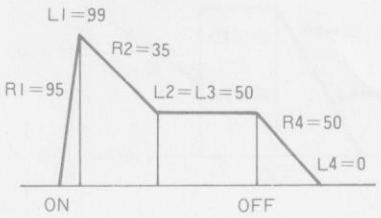


Fig.1/69

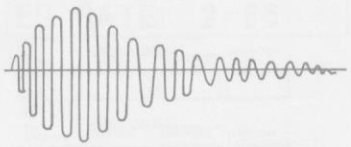


Fig.1/70

EG COPY
from OP1 to OP?

EG COPY

The DX has an EG copy function to copy data from one Operator to another. Use this feature to copy the data from OP1 to OP2. First push the orange switch marked 'STORE'. Although nothing happens at first, keep pushing and it will read EG COPY FROM OP1 TO? (Fig.1/70). Holding down the STORE switch and pressing Switch 2 will change the message to read EG COPY FROM OP1 TO OP2 (Fig.1/71). Now the copying has been completed. It may be done even when the designated Operator is OFF.

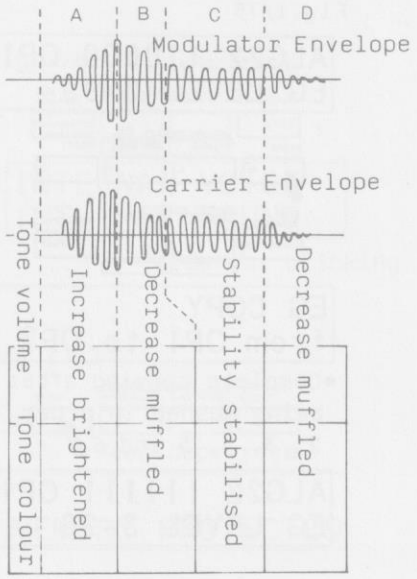
Fig.1/71

EG COPY
from OP1 to OP2

Since OP2 is being used as a Modulator in this Algorithm, the ENVELOPE of the Carrier and the ENVELOPE of the Modulator are the same.

Ignoring the relationship of Carrier to Modulator for a moment, there is no difference between OP1 and OP2 and since their ENVELOPES are identical, the widths of amplitude of the sine waves they are generating are changing in the same way at the same time. Now recalling the relationship, it is said that for the Carrier this represents a change in the tone volume as a function of time, but for the Modulator it represents a change in tickling strength as a function of time. Fig.1/72 shows this clearly. In segment A, the amplitudes of wave generated by both Carrier and Modulator go from 0 to peak. That means that as the tone volume of the Carrier increases towards peak, the tickling strength of the Modulator concurrently increases towards the peak and the tone colour becomes increasingly bright. In segment B the tone volume and the tickling strength diminish side

Fig.1/72

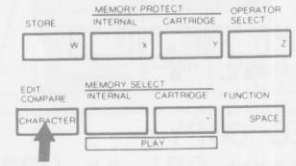


side as decided by RATE 2 and the tone colour becomes increasingly muted. In segment C both hold steady, and in D, after the key is released, volume and tickling strength diminish at RATE 4.

It might be said that the EG function of the Modulator is effectively the same as that of the analog synthesizer even though they are different theoretically. But the manner in which the DX accomplishes these results is far simpler than that of the analog synthesizer. With the DX, only the change in amplitude of the Modulator has to be considered, although the relationship of the OUTPUT LEVEL to the ENVELOPE has to be borne in mind. All ENVELOPE LEVELS are decided relative to the OUTPUT LEVEL. For instance, the actual amplitude of the generated wave is quite different when the output level is 99 from when it is 50 even though in both cases the EG LEVEL may be 99. So the setting of the ENVELOPE character is important. This is especially so when dealing with the Modulator; the quality of tone colour depends directly upon the quality of the OUTPUT LEVEL setting. If this is compared with the VCF of an analog synthesizer, then when the ENVELOPE is set, the Modulator OUTPUT LEVEL may be said to be similar to the EG DEPTH function.

Fig.1/73

Fig.1/74

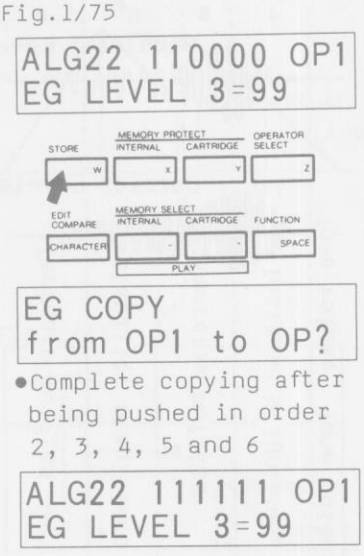


COMPARING SET DATA WITH ORIGINAL DATA

Listening to the setup with both OP1 and OP2 ON, the volume and tone colour are changing together but the feeling of BRASS has been lost. This is because the RATE 1 setting of 95 is too fast and the tone colour changes too rapidly at the beginning so the ATTACK of the BRASS is lost.

To compare the setting now with the original data, just push the EDIT SWITCH and the original data will come back because it switches over to COMPARE MODE (Fig.1/73). The Indicator is flashing to show that it has been switched over to COMPARE MODE and in this state, no data can be changed even by use of DATA ENTRY. To get back to EDIT MODE, just push the switch again (Fig.1/74). Using this, any editing may be compared with the original sound.

Fig.1/75



SETTING A 'STRANGE' ENVELOPE

The ENVELOPE set up to now has been a simple up-down ENVELOPE, the volume rising to a peak and then going down. But other 'stranger' ENVELOPES may be set.

Using OPERATOR SELECT, set LEVEL 3 of the current EG to 99 then copy that ENVELOPE to all the other OPs 2, 3, 4, 5 and 6 and turn them all ON (Fig.1/75).

The resultant ENVELOPE is shown in Fig.1/76. After going down to LEVEL 2 at the speed of RATE 2 = 35, it goes back to maximum volume with LEVEL 3 = 99 at maximum speed, since RATE 3 = 99. What will happen if RATE 2 is speeded up?

Set RATE 2 of OP1 to say around 65 and again copy the ENVELOPE to all other OPs (Fig.1/77). The note sounds twice each time the key is pressed (Fig.1/78).

Fig.1/76

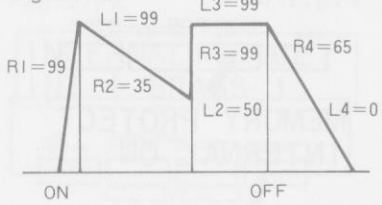
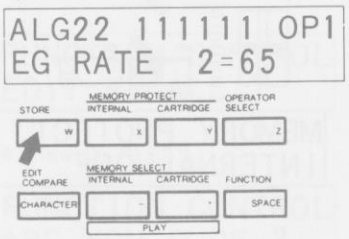


Fig.1/77



EG COPY
from OP1 to OP?

- Complete copying after being pushed in order 2, 3, 4, 5 and 6

ALG22 111111 OP1
EG RATE 2=65

Fig.1/78

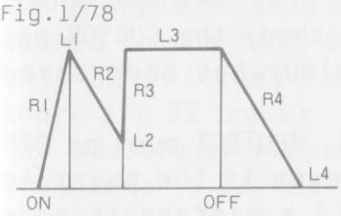
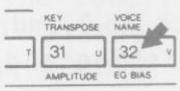


Fig.1/79



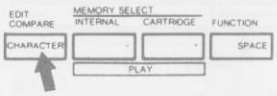
ALG22 111111
NAME=BRASS 1
↑---Cursor blinking

If RATE 2 is set carefully, it is possible to get a SHORT DELAY between the repeated notes. Now that the Operators are at the same settings, interesting sounds can be produced with experimentation.

NAMING THE PRODUCED TONE COLOURS

In order to keep the new sounds and to know where they are, it is necessary to give them names and to write them into the MEMORY BANK of the MAIN UNIT. Push switch 32 of EDIT MODE. The Indicator now shows NAME = BRASS 1 and the black cursor is flashing at the head of the name (Fig.1/79). BRASS 1 can be replaced with any chosen name or numbers. In order to input characters, the CHARACTER switch must be activated and while holding it down, the new name is typed in (Fig.1/80). The CURSOR may be moved to the left or the right by pushing -1 or +1 respectively. The brown switch puts a SPACE in. Failure to push the CHARACTER switch properly will result in the FUNCTION MODE coming up. Should this happen, the EDIT switch must be pushed again to get EDIT back, followed by switch 32 again. When the correct entry has been made, the CURSOR will flash over the last letter written (Fig.1/81). The flashing will not stop until the DATA has been put into MEMORY.

Fig.1/80



Keep depressed

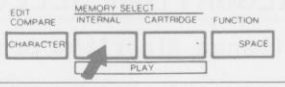
Fig.1/81

ALG22 111111
NAME=DX SOUND 1
Cursor blinking-----↑

STORING OF TONE COLOURS

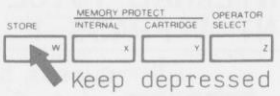
To write this sound into MEMORY 2 of the MAIN UNIT, just push the INTERNAL of the MEMORY SELECT in order to designate MEMORY INTERNAL. Next, SWITCH No. 2 may be pressed while holding down the orange-coloured STORE switch (Fig.1/82). MEMORY PROTECTED will appear as the STORE switch is pressed (Fig.1/83).

Fig.1/82 • Writing



INTERNAL VOICE
INT 1 DX SOUND
↑--Cursor blinking

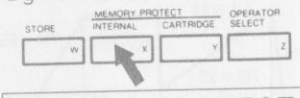
Fig.1/83



Keep depressed

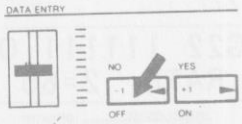
MEMORY PROTECTED

Fig.1/84



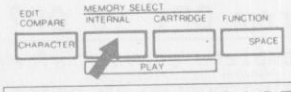
MEMORY PROTECT
INTERNAL ON

Fig.1/85



MEMORY PROTECT
INTERNAL OFF

Fig.1/86

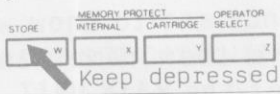


INTERNAL VOICE
INT 1 DX SOUND 1
↑---Cursor blinking

The DX has this facility to protect MEMORY so that it cannot accidentally be erased. To release PROTECT, the STORE switch must be released and the MEMORY PROTECT INTERNAL SWITCH must be pressed (Fig.1/84). The Indicator will show MEMORY PROTECT INTERNAL ON and it will change to MEMORY PROTECT INTERNAL OFF when -1 switch is pressed (Fig.1/85). Now MEMORY PROTECT for the MEMORY BANK of the MAIN UNIT has been released so press the INTERNAL of MEMORY SELECT and STORE (Fig.1/86). This time the Indicator reads INTERNAL VOICE MEMORY STORE. Press switch No.2 and STORE is finished, the CURSOR has stopped flashing and the tone colour has been saved (Fig.1/87).

NB. When DATA is to be stored, PROTECT must be OFF beforehand. PROTECT is always ON even if the power is cut off and on again. However, if a mistake is made such as failing to notice the PROTECT is ON and pushing the STORE switch, the DATA will have gone. But it may be recalled.

Fig.1/87



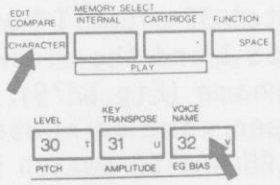
INTERNAL VOICE
MEMORY STORE

INTERNAL VOICE
INT 1 DX SOUND 1

Fig.1/88

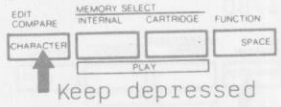
• Fail in writing and edit recall

INTERNAL VOICE
INT 1 BRASS 1



ALG22 111111
NAME=BRASS 1
↑----Cursor blinki

Fig.1/89



• Push F

ALG22 111111
NAME=FRASS 1

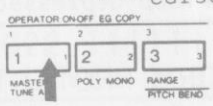
Fig.1/90

ALG22 111111
ALGORITHM SELECT

• Change Algorithm properly

Fig.1/91

INTERNAL VOICE
INT 1 FRASS 1
↑---Cursor blinking



EDIT RECALL

Make a deliberate incorrect entry for the purpose of this test. Recall BRASS 1 of INTERNAL 1 using the PLAY MODE and then switch to EDIT MODE and push switch 32 to rewrite the name at random (Fig.1/88). Change BRASS 1 to FRASS 1 (Fig.1/89), change the ALGORITHM and deliberately make a mistake in writing in the DATA (Fig.1/90). For example, push MEMORY SELECT INTERNAL and push switch No. 1 without pushing the STORE switch (Fig.1/91). This has set it back to PLAY MODE during the EDIT operation so the EDIT data is gone and the name and the tone colour has returned to the original.

To recall the DATA which has disappeared, press the brown FUNCTION switch and switch No.9 (Fig.1/92).

The Indicator will read EDIT RECALL? which means 'Do you want to recall the DATA in EDITING?' Answer 'Yes'. Then it will read, 'ARE YOU SURE?' Answer 'Yes' again. The Indicator will now change to EDIT MODE.

HOW IS RECALL POSSIBLE?

There are 34 places where the tone colours are stored in the MAIN UNIT of the DX although there are only 32 switches for TONE COLOUR MEMORY. This means there are 32 'rooms' to store the TONE COLOUR DATA and two additional rooms where data is stored temporarily. This area is called 'BUFFER A'. The number group at the top of FIG.1/93 is ordinary TONE MEMORY which 'resides' there on a long term basis. The two rooms in the lower part of Fig.1/93 are rooms where data may be stored temporarily. Room A is the one where the data resides at the time of MAKING SOUNDS and EDITING. This means it is in the PLAY MODE. For example, suppose the BRASS 1 DATA goes into Room A, Room 1 does not become empty because BRASS 1 DATA is still there. This may be considered to be a copy of BRASS 1 in Room A. Thus there are two copies of BRASS 1 at this time, when BRASS 1 DATA is changed by the EDIT MODE and the copy being edited resides in Room A

If a mistake were made at this point, the edited DATA would seem to have vanished but in fact it has been moved into Room B (Fig.1/94). EDIT RECALL merely returns EDIT DATA in Room B back to Room A again. This existence of Room B makes it possible to carry out the COMPARE operation mentioned before. When EDIT MODE is set to COMPARE MODE, the DATA in the EDIT moves into Room B and the original data is copied back into Room A again.

Up to now, all the basics of the DX have been covered - what FM is, how the sound is changed by ALGORITHM, how the sound is changed by the OUTPUT LEVEL and FREQUENCY of each Operator, how the ENVELOPE is set, how the ENVELOPE is reflected in the sound, etc.

The two most important things are the Modulator and the Carrier as the sound depends on the kind of sine wave each is generating. If this is understood, it may be applied to everything else.

This is more than 90 per cent of the DX-7 theory.

Fig.1/92

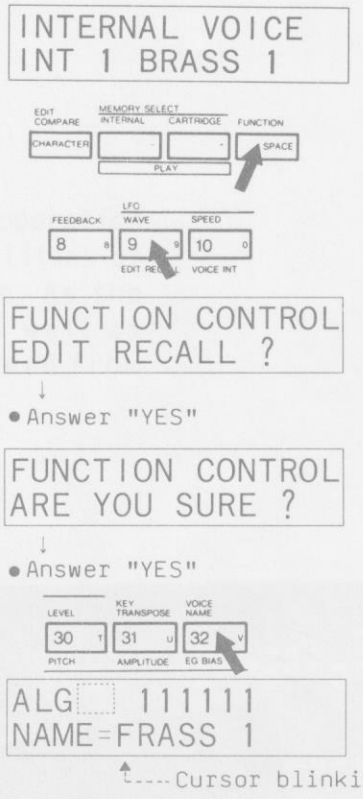


Fig.1/93

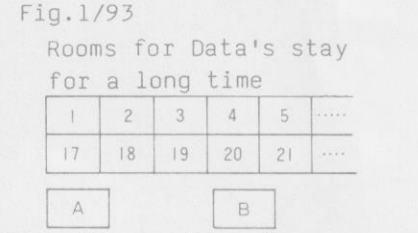
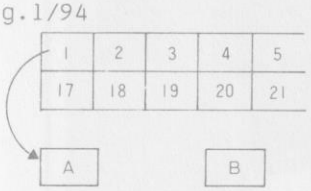
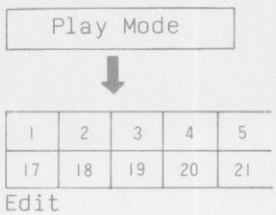
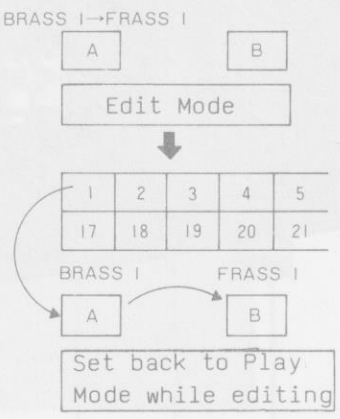


Fig.1/94







MEMORY STORE

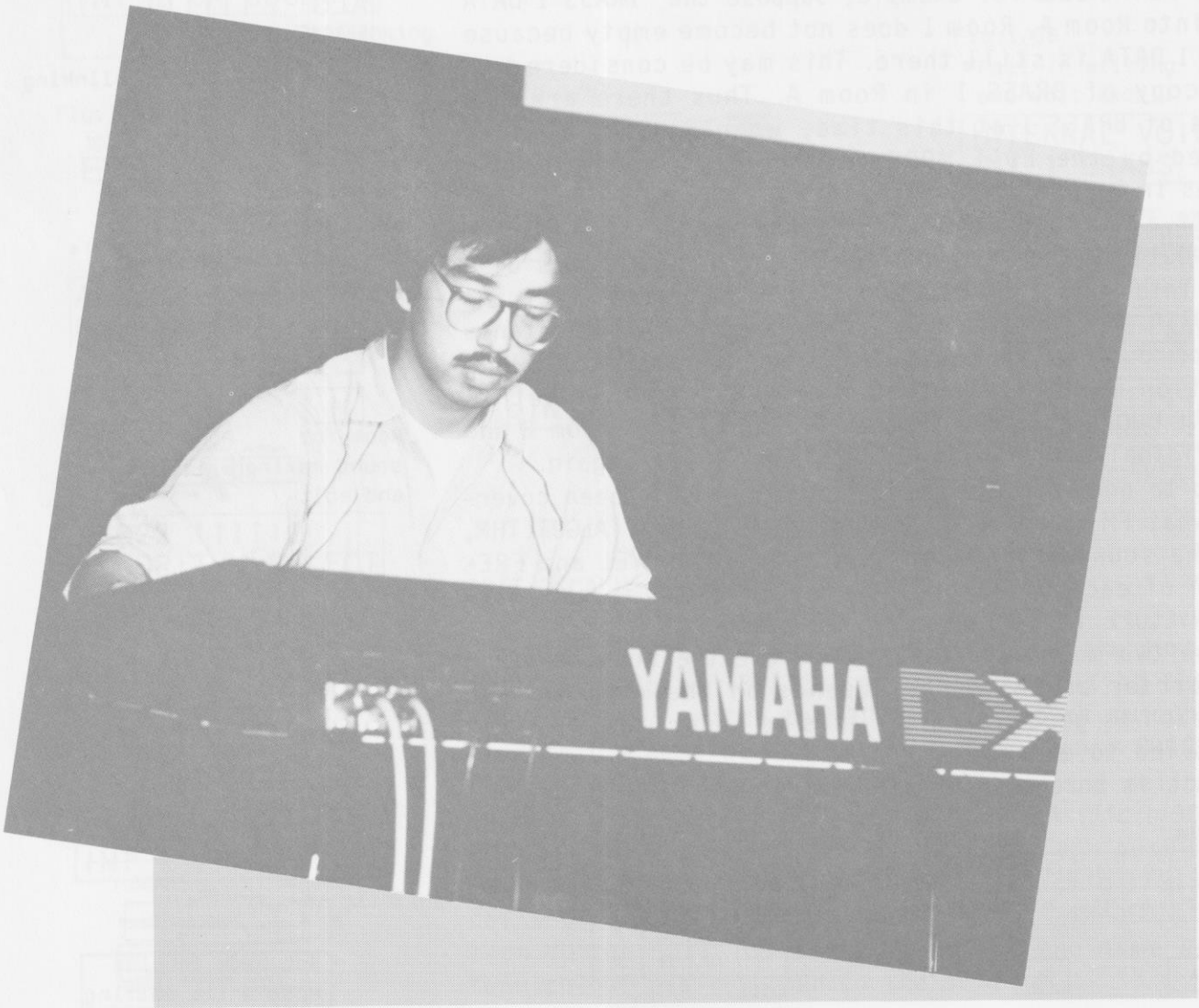
Writing Place
Internal?
Cartridge?
Designation

Store Instruction

Memory Protect is OFF?
Protect is OFF
YES NO

Designation of the number to write

STORE Completion



CHAPTER 2

(APPLICATION)

VARIOUS FUNCTIONS AND USAGES

CHAPTER 1 covered the basic mechanism and operation of the DX. CHAPTER 2 deals with the special abilities of the DX, such as TOUCH RESPONSE and SCALING etc. As the operational procedure is shown by figures as well as written text as in CHAPTER 1, this should be read from the beginning while actually operating the DX.

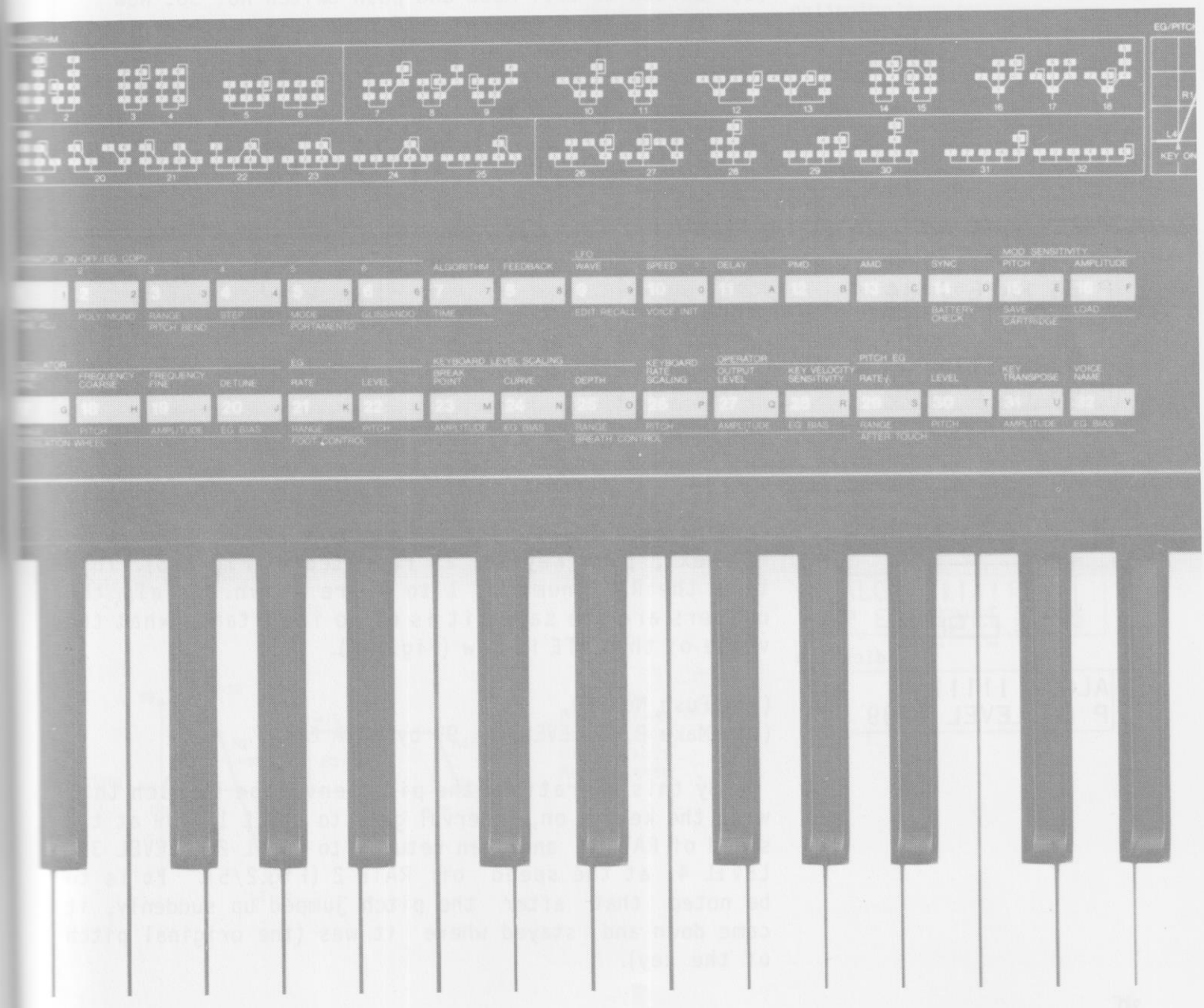


Fig.2/1

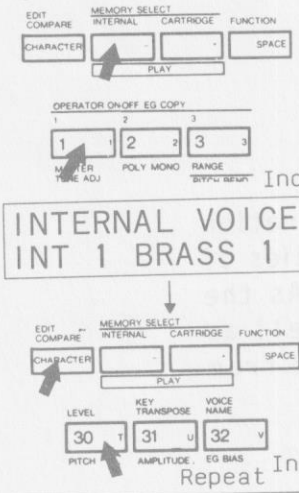


Fig.2/3

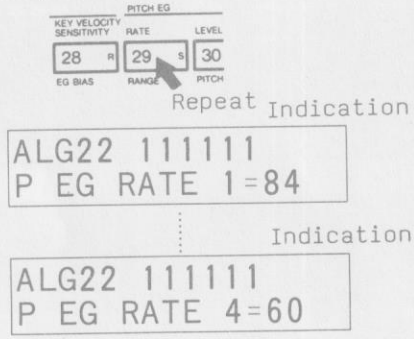
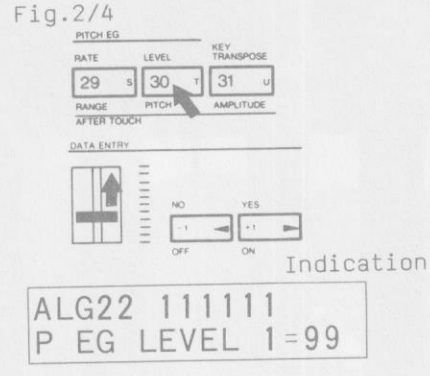


Fig.2/4



1. MAXIMUM USAGE OF EDIT MODE

To get the most out of the DX in developing sounds, it is essential to understand the use of the EDIT MODE.

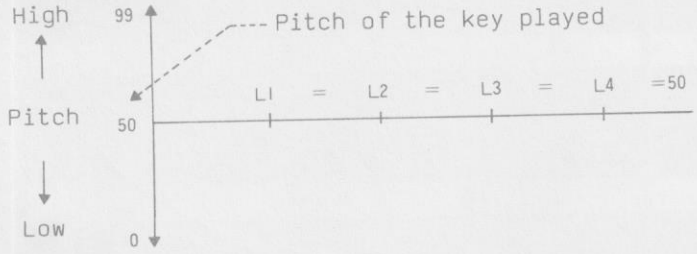
(1) PITCH ENVELOPE GENERATOR

The DX has a PITCH ENVELOPE GENERATOR (P EG) which changes musical intervals at the ON and OFF signal from an Operator's internal EG. This controls the frequency of the sine wave generated by each operator in an algorithm.

PITCH ENVELOPE (Fig.2/1)

(a) Select BRASS 1 of INTERNAL 1 using PLAY MODE.
(b) Switch to EDIT MODE and push Switch No. 30. Now P EG LEVEL 1 indicates 50.
Repeatedly push Switch No. 30. Indication will change to LEVEL 2 = 50, LEVEL 3 = 50, LEVEL 4 = 50 and so on.
Though each LEVEL is 50, in P EG this state is flat, i.e. there is no PITCH ENVELOPE (Fig. 2/2).

Fig.2/2



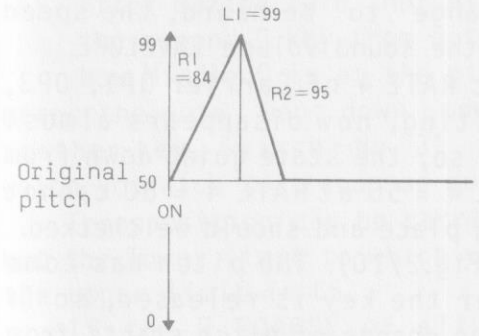
Therefore, when the key A is played, the pitch remains at A whether the key is ON or OFF.

Next, push key No. 29 repeatedly (Fig 2/3). This time the RATE numbers 1 to 4 are shown. As all the numbers are the same, it is of no importance what the value of the RATE is now (Fig.2/4).

(a) Push No. 30.
(b) Make P EG LEVEL 1 = 99 by DATA ENTRY.

By this operation, the pitch envelope is such that when the key is on, interval gets to LEVEL 1 = 99 at the speed of RATE 1, and then returns to LEVEL 2 = LEVEL 3 = LEVEL 4 at the speed of RATE 2 (Fig.2/5). It is to be noted that after the pitch jumped up suddenly, it came down and stayed where it was (the original pitch of the key).

Fig.2/5

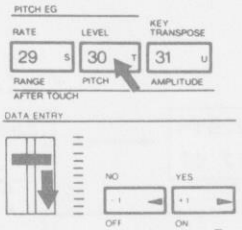


‹Data›

R1=84	L1=99
R2=95	L2=50
R3=95	L3=50
R4=60	L4=50

Next, set P EG LEVEL 2 to 0 (Fig.2/6). Musical pitch rises to LEVEL 1 and goes down to LEVEL 2 and at last returns to LEVEL 3 = LEVEL 4 = 50 at the speed of RATE 3.

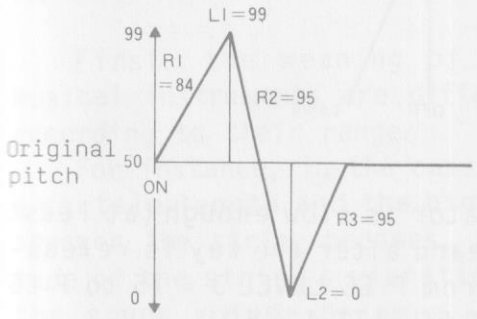
Fig.2/6



Indication

```
ALG22 111111
P EG LEVEL 2=0
```

Fig.2/7

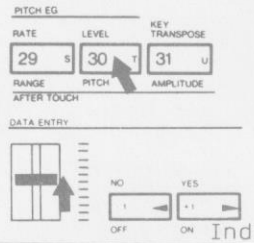


‹Data›

R1=84	L1=99
R2=95	L2= 0
R3=95	L3=50
R4=60	L4=50

Set P EG LEVEL 3 = 75 (Fig.2/8). As LEVEL 3 changes, the pitch produced while the key is on, also changes (Fig.2/9).

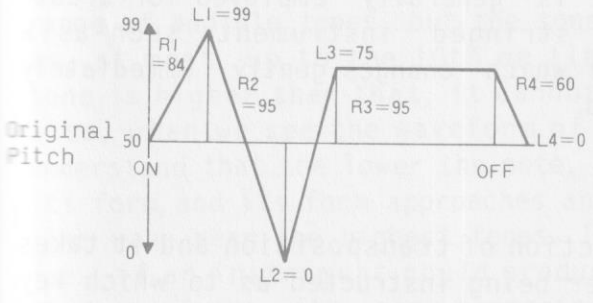
Fig.2/8



Indication

```
ALG22 111111
P EG LEVEL 3=75
```

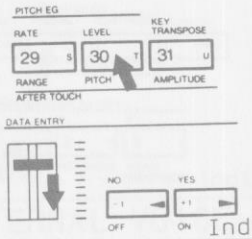
Fig.2/9



‹Data›

R1=84	L1=99
R2=95	L2= 0
R3=95	L3=75
R4=60	L4=50

Fig.2/10



Indication

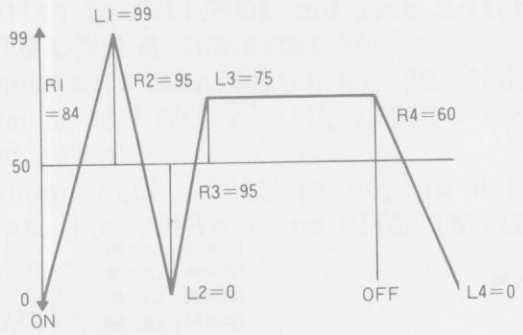
```
ALG22 111111
P EG LEVEL 4=0
```

As for the remaining LEVEL 4, this is the position where the pitch stabilizes after the key is off, and in order for the change to be heard, the speed of RATE 4 must be slow in the sound volume ENVELOPE.

The sound produced at RATE 4 of Carrier OP1, OP3, OP4 and OP5 of BRASS 1 editing, now disappears almost the moment the key is off, so, the state going down from P EG LEVEL 3 = 75 to LEVEL 4 = 50 at RATE 4 = 60 cannot be heard, but it is taking place and should be checked.

Set P EG LEVEL 4 = 0 (Fig.2/10). The pitch has come down to LEVEL 4 = 0 after the key is released, so if the key is played again, the change of pitch starts from LEVEL 0 (Fig.2/11).

Fig.2/11



‹Data›

R1=84	L1=99
R2=95	L2= 0
R3=95	L3=75
R4=60	L4= 0

If RATE 4 of each operator is slow enough (at least lower than 45) it can be heard after the key is released. The pitch goes down from P EG LEVEL 3 = 75 to P EG LEVEL 4 = 0 at a speed of P EG RATE 4 = 60.

This is an extreme example of PITCH ENVELOPE, but it will display its full efficiency when used in SE(special effect) etc.

For instance, if in the setting above, RATE 1 is at a low speed, around 0 - 10, and a key is on, an effect such as an underground rumbling or an airplane approaching may be obtained. This is because the pitch changes very slowly. This is also used for the B group of auxiliary ROM 2 of DX-7 and SE called 'Grand Prix' of CRT 30.

PITCH ENVELOPE is generally employed for creating the sounds of stringed instruments such as a sitar, the pitch of which changes gently immediately after being touched.

(2) KEY TRANSPOSE

This is the function of transposition and it takes place instantly after being instructed as to which key should be selected instead of the Middle C (the third C from the bottom).

(a) Set BRASS 1 to EDIT MODE and push key No. 31 (when it is already in EDIT MODE, push No. 31 only).
(b) After making sure INDICATION is MIDDLE C = C3, play the second C key from bottom (C2).

Now Middle C is at the pitch of C2 (Fig.2/12). This means the note went down one octave. To transpose to another key, Switch No. 31 and the key of the tone to which you wish to transpose must be pushed (Fig.2/13).

Transposition may be carried out by the above method but the lower limit to which you can transpose is C1 and the upper limit is C5.

If the F COARSE of all operators is 1.00, the central key A becomes A1 and oscillates at 110 Hz when it is MIDDLE C = C1. When it is MIDDLE C = C5, the middle A becomes A5 and oscillates at 1760 Hz. The function of this KEY TRANSPOSE is indispensable for obtaining the low notes of musical instruments such as a bass.

When playing a bass, the F COARSE of an operator is usually set to 0.50, and MIDDLE C = C2 (of course the case of F COARSE = 1.00 and MIDDLE C = C1 is the same).

Fig.2/12

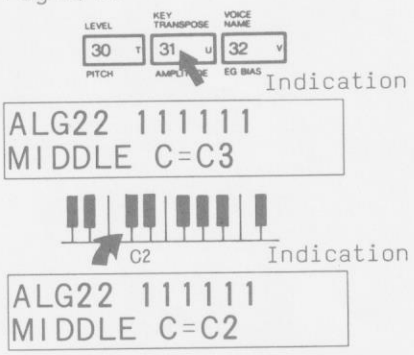
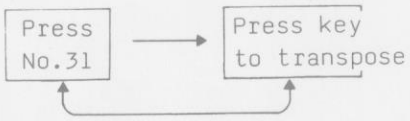


Fig.2/13



(3) SCALING

First, the meaning of 'scaling'. The sounds of musical instruments are different in volume and colour according to their range.

For instance, in the case of a piano each string has a certain length and the higher the tone becomes, the shorter the string becomes, and the smaller the amplitude of the string's vibration in the air, the smaller the sound volume becomes. But in listening, as the higher tone is easily heard, it does not seem that it is too soft. In other words, the higher the tone goes, the smaller the amplitude of vibration becomes, and that makes it feel as if it were wholly flat. If a higher tone has the same amplitude as a lower tone, the former will be more easily heard and the latter will be softer.

The same can be said about tone colour. The tone colours of a keyed instrument like a piano lose harmonics the higher the note on the scale. If the basic is 55 Hz, the 60th harmonic is 3300 Hz. This is within range of audible tones, but the tone audible to our ears is, at most, up to the 10th or 11th harmonic and if a tone is higher than that, it cannot be heard. For instance, when we see the waveform of a piano note, we can understand that the lower the note, the more complicated its form, and its form approaches an almost mathematical sine wave near the highest tones. If this were not so, i.e., if an instrument could produce tones of complicated waveforms with many harmonics in the higher range as well as in the lower range, the higher notes would be

too unpleasant to our ears, like supersonic waves.

In the case of keyed instruments, the higher the tone, the shorter the time to complete one ENVELOPE becomes, which is understandable considering the strings are shorter.

As mentioned, the tone of an instrument differs greatly according to its range (and according to the to of instrument). The scaling function of the DX is used to reproduce these effects. The DX has both a LEVEL SCALING function, which changes the volume and the tone colour in accordance with its range, and a RATE SCALING, which changes the length of the envelope, and can perform scaling for each Operator.

(A) LEVEL SCALING

FUNCTION OF LEVEL SCALING

Level scaling is the function which changes the level of sine waves generated by each operator, i.e. the output level according to the tone range of the keyboard.

In other words, it makes the amplitude of the sine waves generated by each operator large or small.

IF IT IS DONE WITH AN OPERATOR USED AS A CARRIER, THE VOLUME CAN BE CHANGED IN THE RANGE OF THE KEYBOARD. IF IT IS DONE BY AN OPERATOR USED AS A MODULATOR, THE DEPTH OF CHANGE AND TONE COLOUR MAY BE CHANGED.

When the output level of an operator is at the maximum 99, a SETTING in which the volume and degree of tone change is raised is impracticable because it is impossible to exceed the maximum amplitude of vibration.

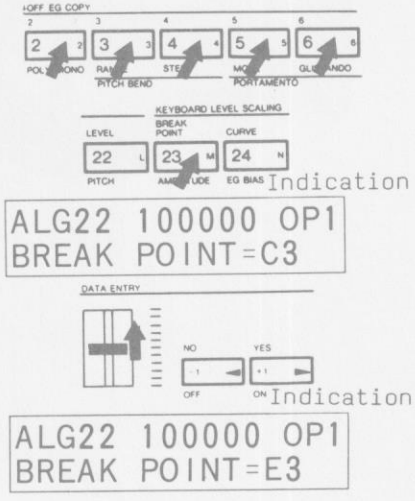
SCALING OF CARRIER OPERATOR (Fig.2/14)

(a) Select BRASS 1 and switch to EDIT MODE (when it is already in EDIT MODE, start from (b)).
(b) Set operators (except for OP1) to OFF.
(c) Select switch No. 23.
(d) Change to BREAK POINT = E3 by DATA ENTRY.

This shows the preparation for scaling of operator OP1 which is a carrier.

When BREAK POINT = E3 is decided, the keyboard is divided into two sides, right and left, with the centre being the 3rd E from the bottom of the keyboard provided the KEY TRANSPOSE is E3. The former is called RIGHT KEY (R KEY) and the latter is LEFT KEY (L KEY). Next select the state, or how the amplitude of the sine wave generated by Operator OP1 changes either side of the centre key of E3. This is called 'The Setting of Curve'.

Fig.2/14

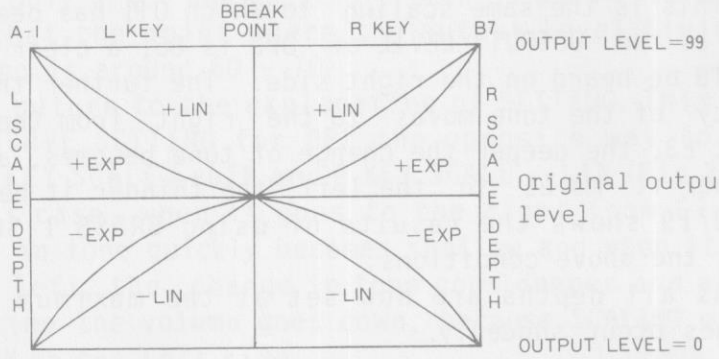


*The upper limit of increase is output level = 99, the lower limit of decrease is output level = 0

There are four states of change. Based on the output level (at present 98) of OP1 by E3 i.e., the key which corresponds to break point, the state increasing output in a straight line from there is called +LIN (LINEAR); the state increasing in a curved line is called +EXP (EXPONENTIAL); the state decreasing in a straight line is called -LIN and the state decreasing in a curved line is called -EXP. These four are divided respectively in R KEY and L KEY, so a total of eight states may be set.

These are shown in Fig.2/15, and are also marked on the body of the DX.

Fig.2/15



(Fig.2/16)

(a) Push No. 24 (When pushed repeatedly, R and L are alternately displayed on the indicator).
(b) By DATA ENTRY, set R KEY SCALE = + LIN.
(c) By DATA ENTRY, set L KEY SCALE = - LIN.

Now, how the operator Output Level increases or decreases according to the range of tone, may be selected. Next, decide where the state should be executed. If SCALE DEPTH = 0 is set, then whatever the set curve might be, the operator Output Level will not change. In other words, SCALING will not take place.

(Fig.2/17)

(a) Push No. 25 (when pushed repeatedly, R and L are alternately displayed on the indicator).
(b) By DATA ENTRY, set L SCALE DEPTH = 99.
(c) By DATA ENTRY, set R SCALE DEPTH = 99.

Although this is a rather extreme setting, it will give a better understanding. When the key to the left of E3 is played, the volume falls suddenly and becomes inaudible on the way. However, if you play to the right of E3 no change in volume is noticeable. This is because with the OUTPUT LEVEL in E3 of OP1 at almost maximum 98,

Fig.2/16

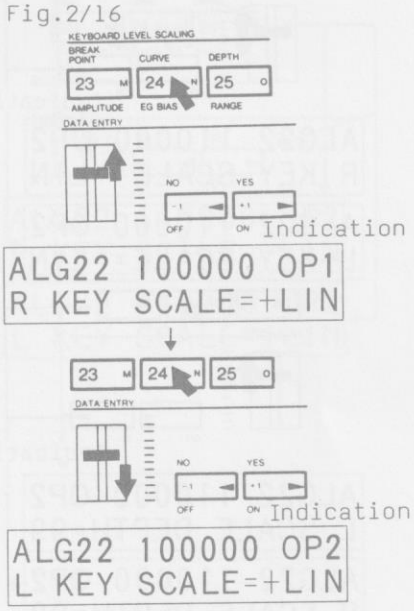


Fig.2/17

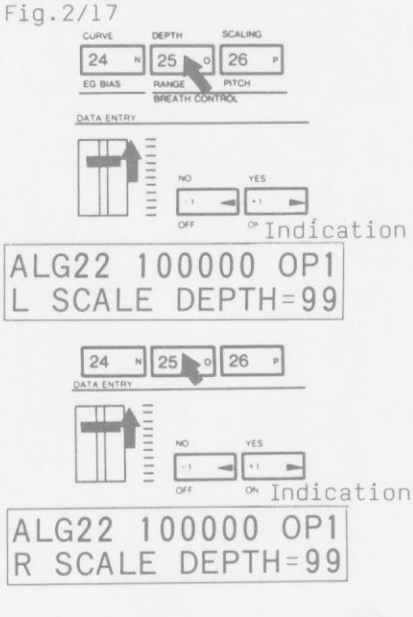
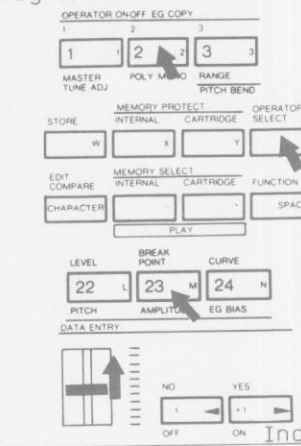
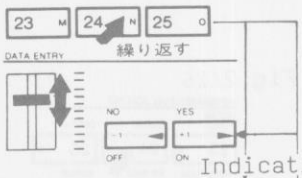


Fig.2/18



Indication

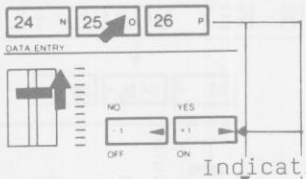
ALG22 110000 OP2
BREAK POINT=E3



Indication

ALG22 110000 OP2
R KEY SCALE=+LIN

ALG22 110000 OP2
L KEY SCALE=-LIN



Indication

ALG22 110000 OP2
L SCALE DEPTH=99

ALG22 110000 OP2
R SCALE DEPTH=99

even if R KEY SCALE is +LIN, the volume can only increase by 1.

OPERATOR SCALING OF MODULATOR

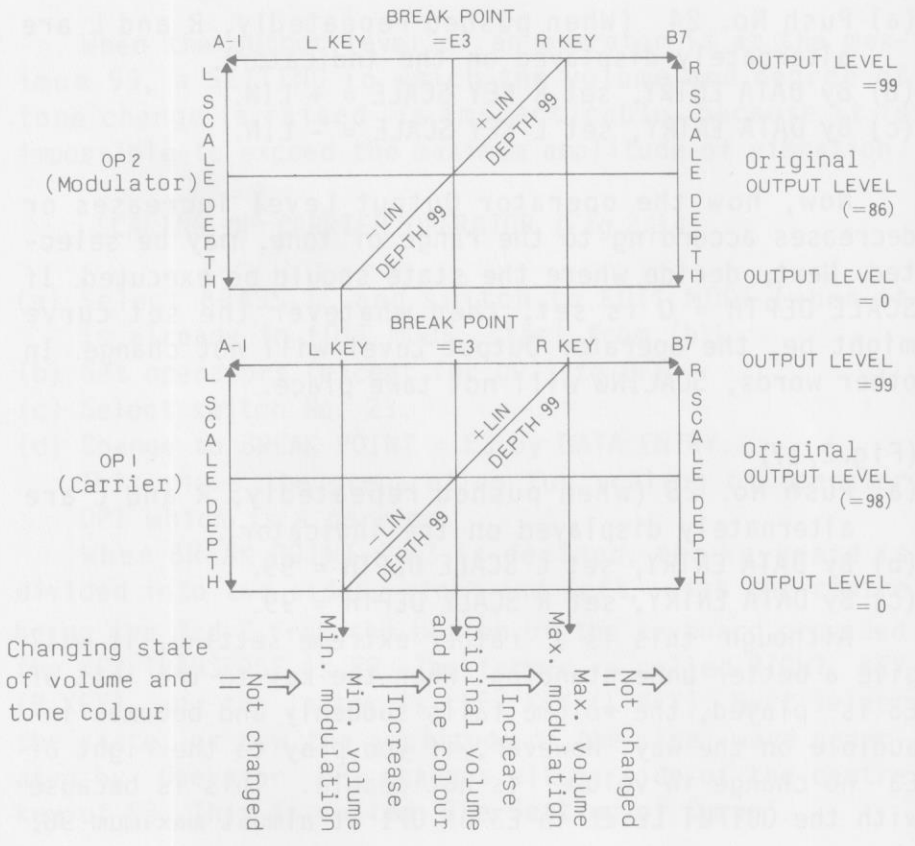
SCALING the MODULATOR using the same parameters as were used for the CARRIER, OP1. Operate as follows (Fig.2/18).

(a) Turn OP2 ON, and indicate OP2 by OPERATOR SELECT.
(b) Push No. 23 and, by DATA ENTRY, set BREAK POINT= E3.
(c) Push No. 24 and by DATA ENTRY set R KEY SCALE = +LIN and L KEY SCALE = -LIN.
(d) Push No. 25 and set R SCALE DEPTH =99 and L SCALE DEPTH = 99.

This is the same scaling to which OP1 has been set, but as the OUTPUT LEVEL of OP2 is 86, a clear effect should be heard on the right side. The further the frequency of the tone moves to the right from the break point E3, the deeper the change of tone becomes, and the further it moves to the left, the thinner it becomes. Fig.2/19 shows the results of using BRASS 1 SCALING under the above conditions.

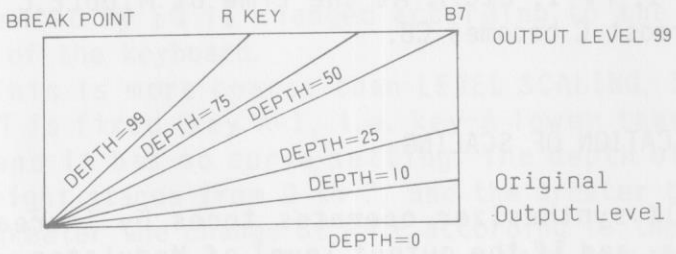
As all depths are now set at the maximum 99, changes occur suddenly.

Fig.2/19



But if depth is not large, the inclination of the curve and rate of change become more gentle. Fig.2/20 shows approximately the relation of DEPTH to Inclination of the curve.

Fig.2/20



In order to keep things simple and easy to understand, only R KEY and CURVE of +LIN is shown. It may be seen that the point where the output level finishes, changing is around 60 - 70.

To return to the explanation of SETTING. This time do a CURVE SETTING for OP2 the opposite way to OP1, i.e. L KEY SCALE =+LIN and R KEY SCALE =-LIN (Fig.2/21). In this case, when it goes to the right from E3, the change in tone quickly becomes shallow and when it goes to the left, the change in tone goes deeper and at the same time the volume goes down, because SCALING of OP1 is -LIN on the left side.

Fig.2/21

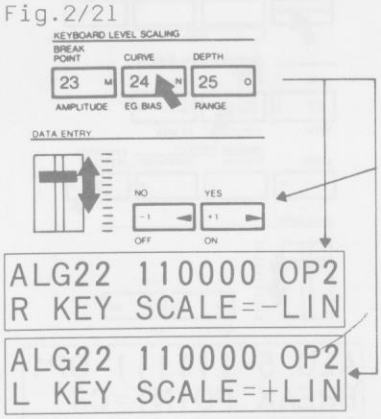
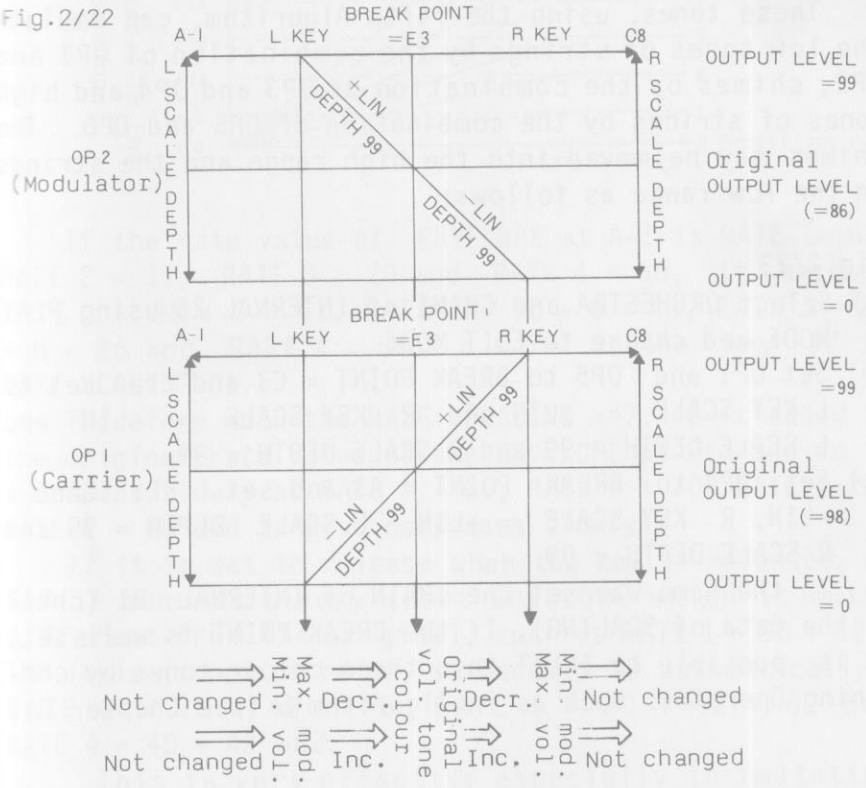


Fig.2/22

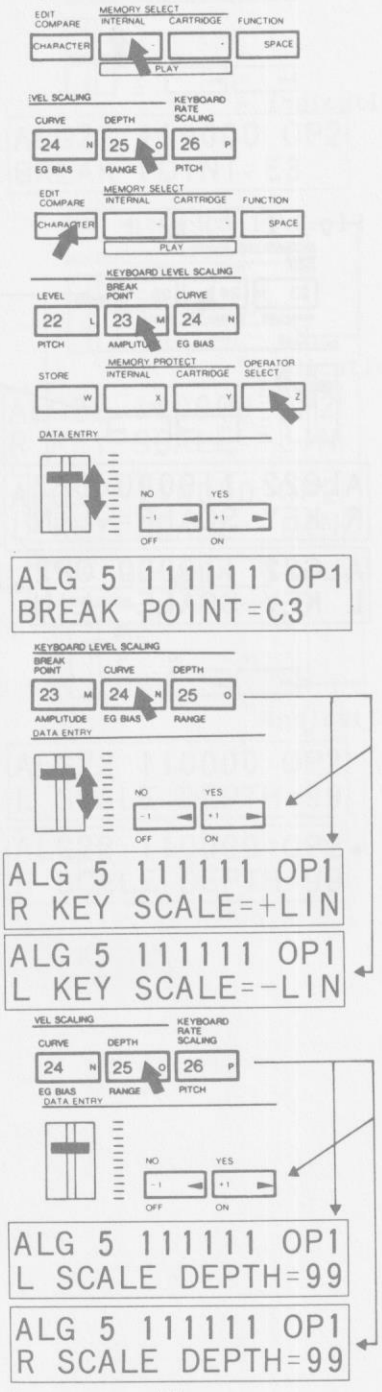


By careful use of LEVEL SCALING some very interesting tones may be made.

Shown were two extreme examples to demonstrate the meaning of, and operation of, SCALING.
Note: It is only in the range of the keys between A1 and B7 that SCALING is possible.

Therefore, when set in MIDDLE C = C1, the first key A becomes A1, and SCALING is possible for keys under it (G#-1, G-1, F#-1, etc.). At the time of MIDDLE C = C5, the uppermost C becomes C8.

Fig.2/23



Same operation after Operator is changed

APPLICATION OF SCALING

The DX synthesizer operates tones by increasing harmonics, and if the output level of Modulator which seems suitable is kept unchanged, even in the range of higher tones, and no change is made in the degree of tone change, then the tones in the higher range become unpleasant. Scaling of the Modulator is a very important way to correct this. If either +LIN or -LIN is selected after SCALING of the Modulator, DEPTH is effective enough at 10 - 20 at the most, although this will depend upon the setting of the OUTPUT LEVEL.

In SCALING of the Carrier a KEY SPLIT may be made using the above data. For instance, several tones, such as ORCHESTRA and CHIME of INTERNAL 25, divide the Carrier tones which sound at the same time into two, right and left.

These tones, using the fifth Algorithm, can emulate the low tones of strings by the combination of OP1 and OP2, chimes by the combination of OP3 and OP4 and high tones of strings by the combination of OP5 and OP6. The chimes may be moved into the high range and the strings in the low range as follows:

Fig.2/23

(a) Select ORCHESTRA and CHIME of INTERNAL 25 using PLAY MODE and change to EDIT MODE

(b) Set OP1 and OP5 to BREAK POINT = C3 and then set to L KEY SCALE = +LIN and R KEY SCALE = -LIN and L SCALE DEPTH = 99 and R SCALE DEPTH = 99.

(c) Set OP4 to BREAK POINT = A3 and set L KEY SCALE = -LIN, R KEY SCALE = +LIN, L SCALE DEPTH = 99 and R SCALE DEPTH = 99.

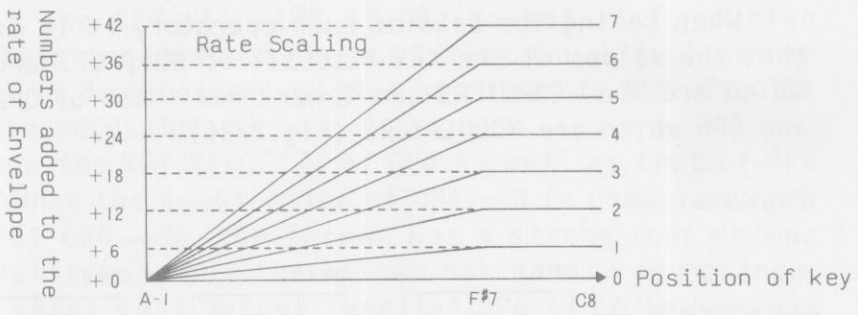
In the same way set the TRAIN of INTERNAL 31 (check on the data of SCALING). If the BREAK POINT is well set, it is possible to SPLIT into three colour tones by combining Operators such as in Algorithm 5 (see Chapter 3).

(B) RATE SCALING

In the case of LEVEL SCALING, OUTPUT LEVEL, the amplitude of the sine wave generated by each operator is changed according to the range of tones of the keyboard, but in the case of RATE SCALING, the RATE of ENVELOPE generated by EG is changed according to the range of tone of the keyboard.

This is more coarse than LEVEL SCALING. Its BREAK POINT is fixed (key A-1, i.e. key A lower than the key C1) and it has no curve setting. The depth of scaling has eight stages from 0 to 7, and the greater the depth, the greater the change of RATE according to the range of tone of the keyboard. The change of RATE SCALING at each stage is shown in Fig.2/24. For instance, at RATE SCALING = 1, the ENVELOPE of KEY A1 is FLAT, i.e. the state set beforehand, the nearer the key approaches F#7, the greater the numerical value added to the original rate of the ENVELOPE, and when the key reaches F#7, the ENVELOPE becomes the original value of rate plus six.

Fig.2/24



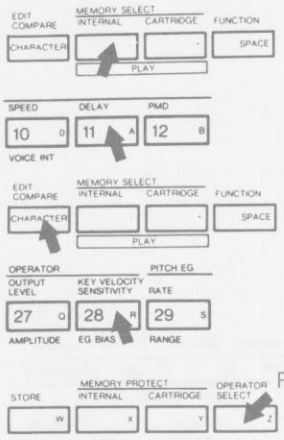
If the rate value of ENVELOPE at A-1 is RATE 1= 85, RATE 2 = 35, RATE 3 = 20 and RATE 4 = 50, it becomes RATE 1 = 85 + 6 = 91, RATE 2 = 35 + 6 = 41, RATE 3 = 20 + 6 = 26 and RATE 4 = 50 + 6 = 56 at the key F#7 in RATE SCALING= 1.

Therefore when the RATE SCALING = 7, 42 is added to the original rate value of the ENVELOPE at F#7 and so it increases slowly at RATE 1 = 60, RATE 2 = 30, RATE 3=20, RATE 4 = 40 and it also decreases slowly.

If it is set to release when the key is released, at F#7 it becomes a very short ENVELOPE which is quite different from the original, such as RATE 1 = 60 + 42 = 102 (this is out of range, so becomes 99 automatically), RATE 2 = 30 + 42 = 72, RATE 3 = 20 + 42 = 62 and RATE 4 = 40 + 42 =82.

This is very effective especially in imitating keyed instruments. Bass 1 of INTERNAL 15 makes the best use of this effect.

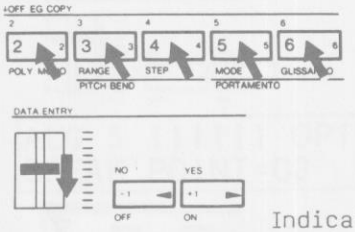
Fig.2/25



Indication

```
ALG 5 111111 OP1
KEY VELOCITY=2
      ⋮
ALG 5 111111 OP6
KEY VELOCITY=6
```

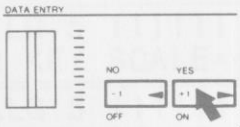
Fig.2/27



Indication

```
ALG 5 100000 OP1
KEY VELOCITY=0
```

Fig.2/28



Indication

```
ALG 5 100000 OP1
KEY VELOCITY=0
      ⋮
ALG 5 100000 OP1
KEY VELOCITY=7
```

Where the KEY VELOCITY of CARRIER is 7, we can get the volume of -50 dB by the key of minimum velocity ON and the volume of +6 dB by the key of maximum velocity ON

(4) KEY VELOCITY

The DX-7 has a control system to monitor the velocity of key touch and to translate this into differences in volume and tone colour. The prominent point of an FM sound source is that volume and tone colour change according to the velocity of key touch, if the output level of each Operator is controlled. The size of the amplitude change is decided in eight stages, from 0 to 7 by SWITCH No. 28 KEY VELOCITY SENSITIVITY. This function has a great effect, especially in producing percussive sounds. An example of what effect it really has and how it is used is shown in the following:-

(FIG.2/25)

(a) Select PLAY MODE, INTERNAL 11, E PIANO 1 and change to EDIT MODE.

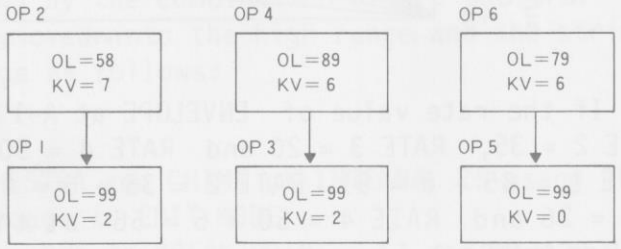
(b) Select KEY VELOCITY by pressing Switch No. 28 and look at the data of each Operator.

This sound of electric piano is a typical example which makes the best use of KEY VELOCITY.

When seeing the data of each operator, it is evident that the values of the KEY VELOCITY of OP1, OP3 and OP5, which are the CARRIERS are lower than those of OP2, OP4 and OP6 which are MODULATORS (Fig.2/26).

Fig.2/26

KEY VELOCITY and OUTPUT LEVEL of Electric Piano



This means that tone colour changes more than tone volume according to touch. (Fig.2/27).

(a) Turn off OP2, 3, 4, 5 and 6.

(b) Turn KEY VELOCITY of OP1 to 0.

Now, KEY VELOCITY of OP1, which is CARRIER, is 0, so there is no change of tone volume produced by the touch, and sounds always come out at the original OUTPUT LEVEL = 99. When played lightly, with a slowly rising KEY VELOCITY, volume goes down, and the more strongly played, the more the volume approaches the original level (Fig.2/28).

If at the time of KEY VELOCITY = 7 the key is struck lightly (the minimum speed which the sensor of the DX can detect), it becomes almost inaudible, and if the key is struck as heavily as possible (the maximum speed which the sensor of the DX can detect) the volume may be obtained above the output level set beforehand.

If an operator used as a CARRIER has too high a KEY VELOCITY, the dynamics of the tone volume in relation to touch are too high. So it is best that a carrier operator does not have too much KEY VELOCITY at a performance except when making sounds of a wide range such as GUITAR 1 of INTERNAL 12. As may be generally seen from the data of E PIANO 1, about 1 - 4 is sufficient for KEY VELOCITY of a CARRIER OPERATOR. On the contrary, in the case of the KEYVELOCITY of a MODULATOR OPERATOR, various cases can be considered.

It is necessary to consider the relationship to output level.
(Fig.2/29)

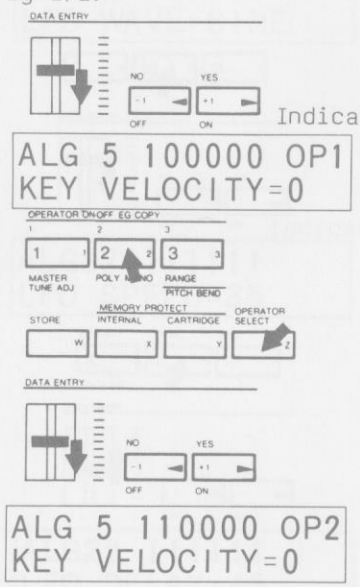
(a) Set KEY VELOCITY of OP1 to 0.
(b) Turn on OP2 and set to 0 by DATA ENTRY after making sure that the KEY VELOCITY of OP2 is 7.

As the KEY VELOCITY of OP2 is set at 0, a high metallic tone may be heard whether touch is light or heavy. It is necessary to give attention to KEY VELOCITY for the MODULATOR.

Now the KEY VELOCITY of OP4 as well as that of OP6 is 6. When the combination of OP4 → 3 is compared with that of OP6 → 5, the former has a strong tone colour when attacked, but the latter has hardly any change. This means that output level of OP6 is 10 lower than that of OP5 and the tone of OP6 → 5 is rather light from the beginning. When a distinct change of tone colour according to the weight of touch is desired, there must be some effect in change of tone when the KEY VELOCITY of the MODULATOR is zero. In other words, it is important that the output level of the MODULATOR be high enough.(Output level of OP2 is 58, but this is sufficient to make a high metallic tone by the combination of OP2 → OP1.

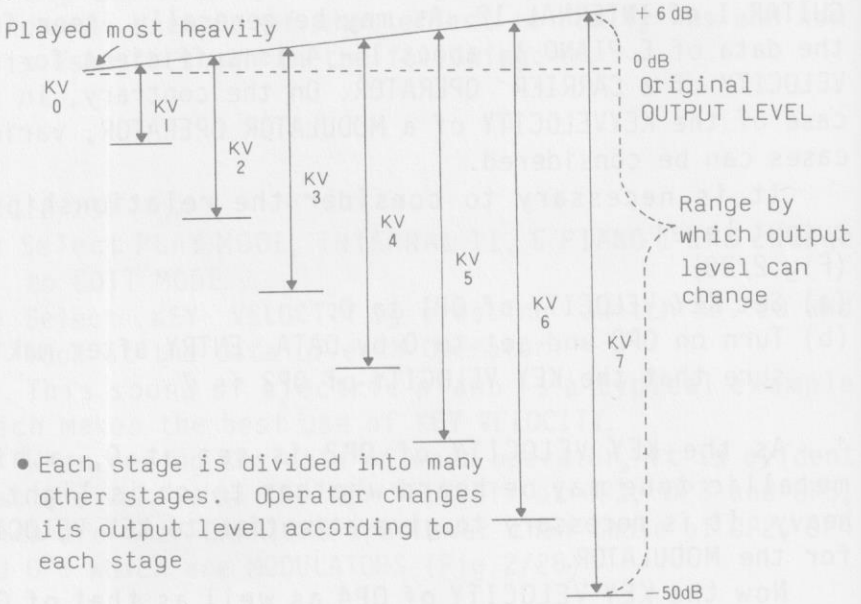
In the case of E PIANO 1 mentioned above, KEY VELOCITY of the Modulator is usually very large; it is better for it not to be too large when used for brass and strings. For instance, as for brass tone, KEY VELOCITY is put into the Modulator at 6 or 7 and when played lightly, the change of tone is too weak and is reduced to just a sine wave. Therefore the balance with the tone played strongly becomes confused.

Fig.2/29



E PIANO 1 is essentially an instrument which generates sine waves by using a light touch. Look at the data of KEY VELOCITY for various tones and try to edit by referring to the above points. In fact, it is also very effective in editing to change the effect of KEY VELOCITY. In conclusion, the changeable rate of OUTPUT LEVEL at each stage by Operator by KEY VELOCITY is shown as follows (Fig.2/30).

Fig.2/30
Range which output level changes by KEY TOUCH VELOCITY



(5) DETUNE

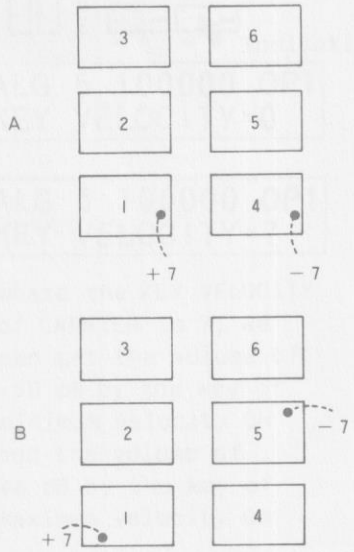
This is a device which finely shifts the frequency of the sine wave generated by each operator, and can give a swell and a depth to the tone colours of Organ, Electric Piano and String Instruments.

This is divided into 15 stages from -7 to +7. When detune is + or - 7, it makes the largest shift, i.e. about + or - 4 Hz at a frequency of about 2000 Hz. (Of course, it does not become + or - 4 Hz equally at all pitches but the amplitude shift becomes smaller when the frequency is lowered).

The problem is how to detune. It is common to detune carriers contrasting with each other, but in this case we cannot have an effective Detune.

For instance, if we set OP1 of Fig.2/31 A at DETUNE = +7 and set OP4 at DETUNE = -7, using ALGORITHM No. 3, the effect of tuning becomes confused. For the amount of DETUNING to be narrow is good but it is not so interesting when set as shown in Fig.2/31B. Some of the feeling of shifting in pitch disappears, producing a chorus effect. Try to get detune between the operators which are situated on a diagonal, and set so that one is +5

Fig.2/31



pressed, there will be some vibrato at the timing set by DELAY. After ascertaining this, change the above data a little either way to get the desired effect.

Change WAVE ... What is better for the VIBRATO effect ∿ wave or ∧ wave?
Change SPEED ... The best speed for VIBRATO is about 30 - 40.
Change DELAY ... When DELAY is 0, there is VIBRATO the moment a key is depressed.

When PM represented by Vibrato is preset, the most important thing is the relation between PMD and PM SENS. PM SENS is the master (in a word, boss) and has the decisive power to select the depth of PM by WHEEL and AFTER TOUCH. PMD decides only the depth of preset PM. The following setting is required to get the effect of preset PM.

PM SENS (changeable range from 0 to 7) > 0 and
PMD (changeable range from 0 to 99)> 0.

When PM SENS is 0 and PMD is 0, there is no effect of PM (including WHEEL, AFTER TOUCH, etc.) by the LFO.

When PM SENS is 0 and PMD is larger than 0, there is no effect of PM (including WHEEL, AFTER TOUCH and others) by LFO.

When PM SENS is larger than 0 and PMD is 0, there is no effect of preset PM, but the effect of PM by WHEEL and AFTER TOUCH can be accomplished.

Note: Refer to the section on FUNCTION CONTROL MODE with regard to PM by WHEEL and AFTER TOUCH.

c. PRESETTING OF AM USING LFO

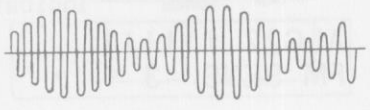
PM means to vibrate pitch by the effect of LFO, whilst AM (Amplitude Modulation) means to vibrate the amplitude of the sine wave generated by each Operator.

AM on an Analog Synthesizer meant that the LFO signal was sent to the VCA which decided tone volume and modulated amplification degree. It was limited to TREMOLO and Ring TONE CHANGE, but, on the DX, AM creates TREMOLO and WOW. If, in an algorithm, AM is applied to the Carrier Operator, the amplitude of an audio signal generated by the Carrier changes periodically (but this depends on the velocity setting of LFO and the kind of wave),so it has the effect of TREMOLO itself (Fig.2/34).

But if AM is applied to the Modulator Operator, the amplitude of the tone change signal changes periodically. Thus, tone change from shallow to deep, is repeated, giving an effective WOW which has a periodical

Fig.2/34

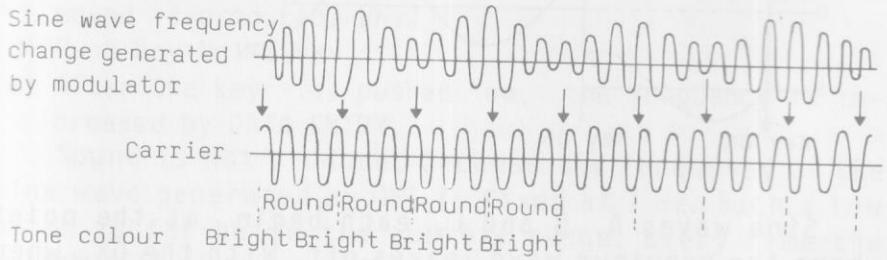
●Frequency change of amplitude of vibration of sine wave



change of tone colour (Fig.2/35). This is similar to a weak and strong tickling repeated periodically.

Fig.2/35

Effect of wow-wow is made by putting AM in Modulator.



When presetting AM, AM SENS (Amplitude Modulation Sensitivity), which is the controller of the DX's AM, is set for each operator, and then AMD (Amplitude Modulation Depth) is set.

To preset the effect of TREMOLO:

(a) Set No.12 PMD back to 0 in order not to mix it with VIBRATO

(b) Push No.13 and set AMD to 60 by means of DATA ENTRY.

(c) Push No. 16 and set AM SENS of the Carrier Operator to 3 (in this case OP1, OP3, OP4, OP5). Wave, Speed and Delay can be as before.
Now, TREMOLO is set. Accordingly if preset TREMOLO is wanted among Preset AM, this SETTING is required. AM Sens (changeable range from 0 to 3) of the Carrier Operator is larger than 0 and AMD (changeable range from 0 to 99) is larger than 0.

To preset the effect of WOW:(Fig.2/37).

(a) Set AM SENS of OP1, OP3, OP4 and OP5 back to 0.

(b) Set AM SENS of OP2 and OP6 to 3.

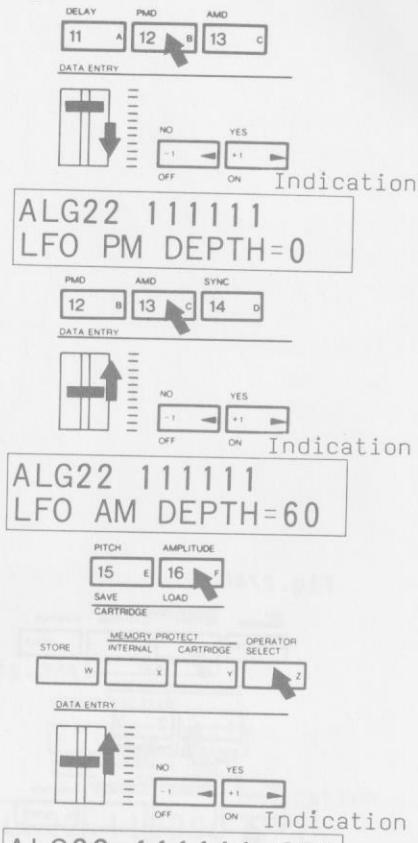
Now Preset TREMOLO has been changed to Preset WOW. To set Preset WOW in Preset AM, the following setting is required:

Both AM SENS (changeable from 0 to 3) of the Modulator Operator and AMD (changeable range from 0 to 99) are larger than 0.

d. KEY SYNCHRO OF LFO

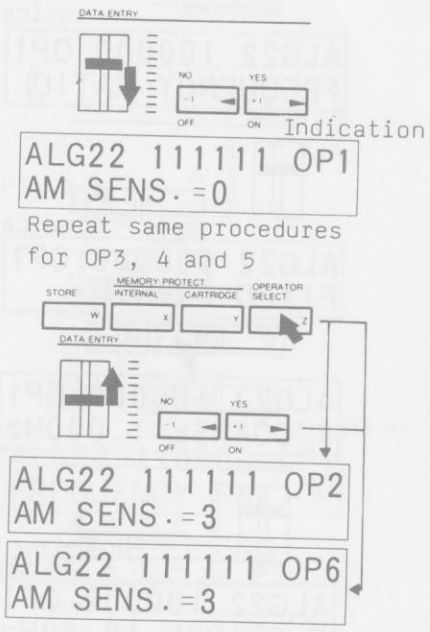
The SYNCHRO of LFO means the wave generated by LFO always begins at a certain point when a key is on. When SYNCHRO is off, the wave of LFO is swelling as if it were independent of key down and up timing. If the keys of A B and C are played one after the other with VIBRATO set to sine wave, the state when SYNCHRO is OFF is as shown in Fig.2/38.

Fig.2/36



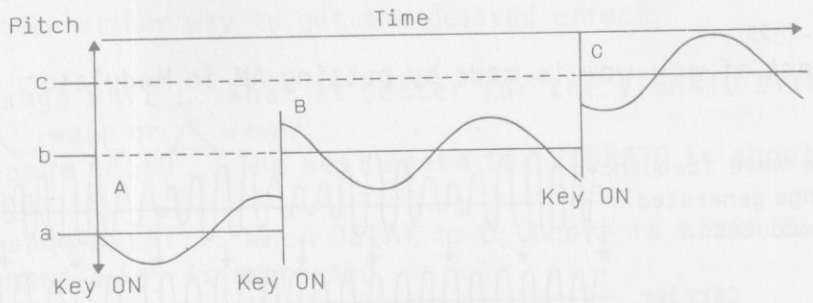
Repeat same procedures for OP3, 4 and 5

Fig.2/37



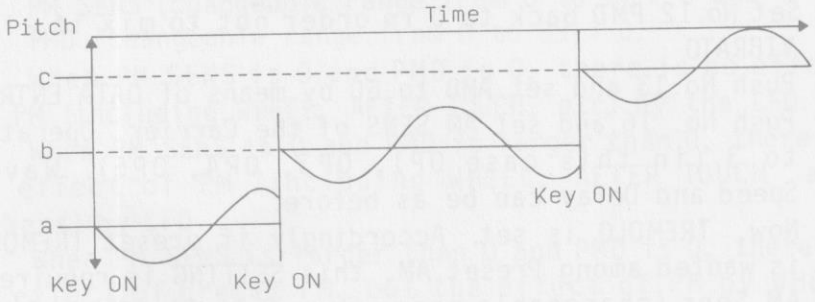
Repeat same procedures for OP3, 4 and 5

Fig.2/38



Sine waves A, B and C, each begin at the point where the previous wave leaves off. With the DX, when SYNCHRO is on, the sine wave of LFO always starts from the CENTRE of the wave as shown in Fig.2/39.

Fig.2/39



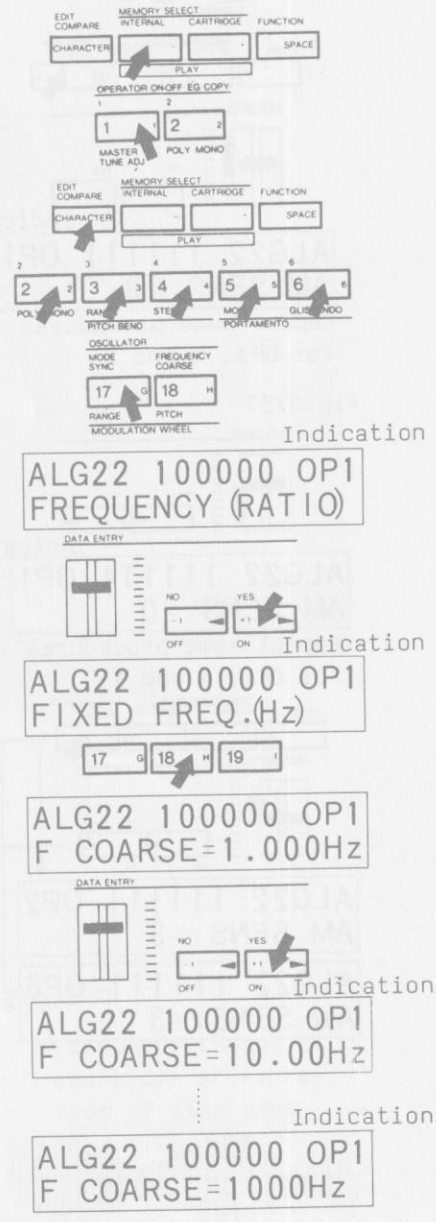
Making use of this feature, the sound of a SYNTHESIZER DRUM may be produced (See Chapter 3).

(7) OSCILLATOR MODE

Each operator of the DX usually generates different frequencies according to the position of the key played. If F COARSE of the Carrier is 1.00 and F COARSE of the Modulator is 1.00 (if Middle C is C3), both of the operators oscillate at 440 Hz with key A3, 880 Hz with key A4 and 1760 Hz with key A5, and if the ratio of Carrier to Modulator is decided, any key, when played, will produce fundamentally the same tone colour. Therefore, a scale may be played on the keyboard. This is called the 'Frequency Ratio Mode'.

When the MODE is switched to the FIXED MODE, it oscillates only the single frequency set by F COARSE, even if any key of the operator is pushed ON. Take, as an example, the REFEREE'S WHISTLE of INTERNAL 29, it will be the easiest one to understand. In the case of this tone, all the six operators are in FIXED MODE and even if any key is on, the same pitch and tone colour are produced.

Fig.2/40



(Fig.2/40).

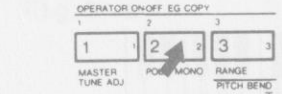
(a) Select BRASS 1 of INTERNAL 1m change to EDIT MODE.
(b) Set OP2, OP3, OP4, OP5 and OP6 to OFF.
(c) Push Switch No. 17. Push Switch YES (+1) of DATA ENTRY and change the indication 'FREQUENCY RATIO' to FIXED. Play a key. Whichever key is played no sound is produced. Why?
(d) Push key No. 18.
(e) After the key is pushed on, the frequency is increased by DATA ENTRY.

Sound is not produced because the frequency of the sine wave generated by OP1 is fixed at 1 Hz. Such a low pitch is far below the audible range. Every time the switch YES(+1) is pushed, the frequency is increased ten times(10x). No sound is heard yet even when the frequency is 10 Hz. As it reaches 100 Hz a sound is heard such as when an empty beer bottle or a recorder is blown. With this setting any key produces the same note when played. If F FINE is used, a fairly fine frequency may be set.

If OP2 is set ON in this state, a very unusual sound will result (Fig.2/41). As OP2 is in the MODE of RATIO, the frequency of the sine wave generated by the key played, changes. However, as the frequency generated by OP1 is fixed, every key has a different frequency ratio of CARRIER to MODULATOR and has a slightly different tone colour from the others. But the ratio of CARRIER to MODULATOR in this state is mostly random, so a reasonable sound cannot be expected.

If OP2 is also in FIXED MODE, sound such as the REFEREE'S WHISTLE of INTERNAL 29 will result. The FIXED MODE is interesting only when the MODULATOR is FIXED and CARRIER is RATIO.

Fig.2/41



Indication

ALG22 110000 OP1
F COARSE=1000Hz

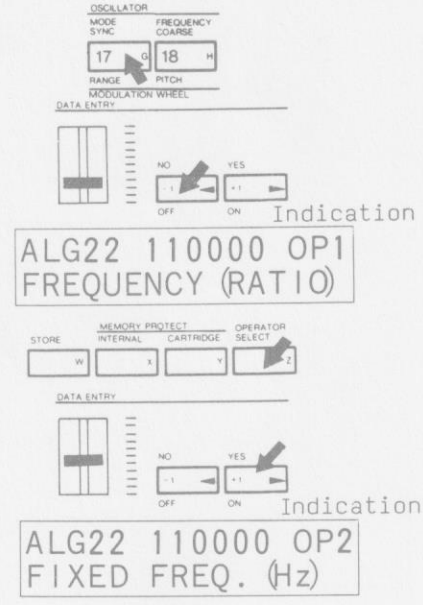
Fig.2/42.

(a) Push No.17 and set MODE of OP1 back to RATIO by means of DATA ENTRY
(b) Change MODE of OP2 to FIXED by means of DATA ENTRY.

When the key is ON in this state, the audio signal generated by OP1 has a slow VIBRATO. This means that OP2 is generating the same frequency whichever key may be on, and is modulating OP1. In short, this means it has become a LFO.

In this case, F COARSE and F FINE of OP2 work as LFO SPEED, and the OUTPUT LEVEL of OP2 has the same role with PMD as mentioned above. Even if it has become FIXED MODE and LFO, the genuine LFO is far better because it can only produce a sine wave (if an operator with feedback is FIXED, a SAWTOOTH waveform will result). But if the operator is fixed and becomes LFO,it is able to apply an ENVELOPE to the depth of tone change.

Fig.2/42



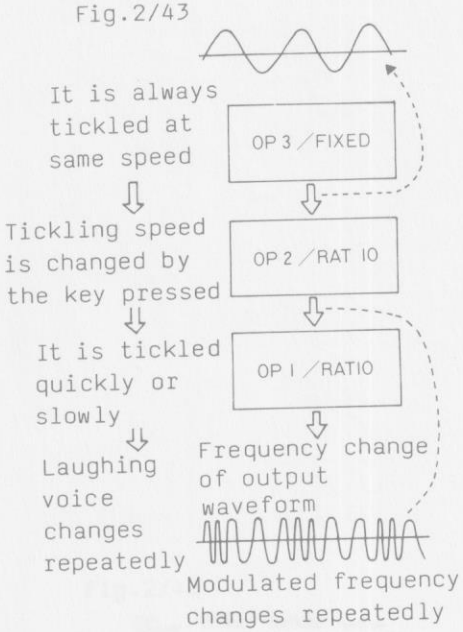
Indication

ALG22 110000 OP1
FREQUENCY (RATIO)

Indication

ALG22 110000 OP2
FIXED FREQ. (Hz)

Fig.2/43



With LFO there is only a simple envelope called 'DELAY' to delay MODULATION, but in the case above, depth may be controlled in a far more sophisticated manner as the EG of the operator which has become an LFO may be used. Using FIXED MODE with the ALGORITHM shown in Fig.2/43, OP3 will apply VIBRATO to OP2, and then the frequency generated by OP2 changes periodically, so OP2 modulates OP1 with its own wave repeating the change.

This means that the frequency rate of OP2 and OP1 slide repeatedly, so, due to this, the waveform generated by OP1 changes periodically. This can be used to produce an effect similar to a chorus. If switch No. 17 is pushed once again, SYNCHRONIZER may be made ON or OFF. This is the same effect as the SYNCHRONIZER of LFO.

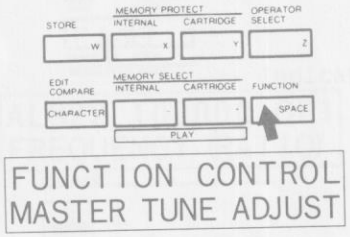
Note: If the OUTPUT LEVEL of OP3 is too large, OP1 receives PITCH MODULATION.

2. FUNCTION CONTROL MODE

The DX-7 FUNCTION CONTROL is common to all the tone colours of the MEMORY and is the MODE used to decide the CONTROLS of the KEYBOARD, such as the change range of the PITCH BENDER, the setting time of PORTAMENTO, the control of MODULATION BY WHEEL, and so on.

It is possible to switch to the FUNCTION CONTROL MODE from PLAY MODE, EDIT MODE or COMPARE MODE. When the brown switch marked FUNCTION is pushed, the words 'FUNCTION CONTROL' appear in the liquid crystal panel (Fig.2/44).

Fig.2/44



In this MODE, the thirty-two switches on the right side are used to choose the contents shown by the brown letters indicated under them as follows:

(1) NO. 1 MASTER TUNE ADJUST

In this state, TUNING is possible by using DATA ENTRY. A noteworthy fact here is that FUNCTION MODE is still on even after the indication on the liquid crystal panel disappears.

(a) Indicate MASTER TUNE ADJUST on the liquid crystal panel, and ascertain that TUNING is possible by the DATA ENTRY.

(b) Set back to PLAY MODE (any tone colour will do).

At this time there is no indication of MASTER TUNE ADJUST on the liquid crystal panel, but TUNING is possible by DATA ENTRY. This is the same with other functions of the FUNCTION CONTROL MODE. Without knowing this, if DATA ENTRY is moved it will cause trouble. (It is better to push Switch No. 14 of FUNCTION CONTROL.)

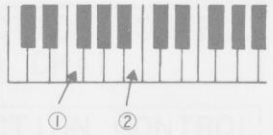
No. 2 POLY AND MONO

This puts the keyboard into either polyphonic or monophonic MODE. It is possible to switch from POLYPHONIC to MONOPHONIC by pressing the YES switch of DATA ENTRY or by pushing the SLIDER up to the top.

When the DX is in Monophonic mode, the last tone played has priority over any played before. Therefore when a key is pressed while another key is ON, the tone of that key is produced without regard to whether the key is higher or lower than the previous key. If played in the manner shown below, sound can be produced on one side only.

Push the desired keys in the order of 1 and 2 and keep them pushed (Fig.2/45).

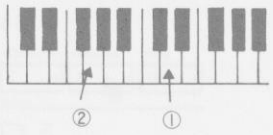
Fig.2/45



When another key is pushed while keys 1 and 2 are kept depressed, only keys to the right of 2 produce sound.

Push the desired keys in the order of 1 and 2 and keep them pushed (Fig.2/46).

Fig.2/46



When another key is pushed while keys 1 and 2 are held down, only keys to the left of 2 produce sound.

If two DX's are used connected by MIDI, a very interesting effect can be obtained by making use of this fact (Refer to the section on MIDI).

In Monophonic mode, the synchronous tone produced can be toned down from 16 to 1, so there is no tone thickening or related phenomenon. As this mode can produce what is called 'Fingered Portamento' (Portamento is heard only when played legato), it will be very effective in producing solo tones.

No. 3 PITCH BEND RANGE

This decides the range of pitch changed by the PITCH BENDER. The range of change is from 0 to 12, and this numerical value corresponds with the interval of keyboard. For instance, if the PITCH BENDER is up when the PBR is 1, the pitch rises by one key, i.e. a semitone.

Accordingly if the PITCH BENDER is up when the PBR is 12, the pitch goes up by an octave. It is better to keep the PBR between 5 and 7.

NO. 4 PITCH BEND STEP

This is a special function of the DIGITAL system, by which special scales and widely spread chords may be played.

When the key is played and;-
PBS is 1, i.e. a semitone, or
PBS is 2, i.e. tone scale, or
PBS is 3, i.e. diversification of diminished chord or
PBS is 4, i.e. diversification of + 5th chord, or
PBS is 5, i.e. tones of 1st, 4th and 7th, or
.
.
.
PBS is 12, i.e. tones of 1st and octave, then those tones above are produced. If this is done playing chords, an interesting effect will be achieved.
NB. When the PBS is larger than 0, PBR is automatically set to 12 and the ordinary PITCH BEND function is lost. Care must be exercised.

No. 5 PORTAMENTO MODE

In the DX there are four kinds of PORTAMENTO MODE; two POLYPHONIC MODES and two MONOPHONIC MODES (but only when PORTAMENTO TIME is greater than zero).

POLYPHONIC

(1) SUS - KEY P FOLLOW MODE
(a) Set a key ON, step on the Sustain Pedal and release the key.
(b) Push another key while the Sustain Pedal is depressed. Then the tone changes from the former to the latter place. The first tone is lost (common PORTAMENTO).

(2) SUS - KEY P RETAIN MODE
If both (a) and (b) are done in the same way, the note of the first key played sustains, and the note of the next key which is played is superimposed upon it. This produces a very wide sound.

MONOPHONIC
(1) FULL TIME PORTAMENTO MODE
PORTAMENTO (common PORTAMENTO) may be obtained at any time.
(2) FINGERED PORTAMENTO MODE
PORTAMENTO is only effective when the keys are played legato. This effect is shown at its best in a violin or string bass solo.

No. 6 PORTAMENTO AND GLISSANDO

This chooses either PORTAMENTO (change of pitch in succession) or GLISSANDO (change of pitch by semitones).

No. 7 PORTAMENTO TIME

This decides how long PORTAMENTO is applied in 100 stages from 0 - 99. When it is 0 the time for PORTAMENTO is 0, so nothing happens.

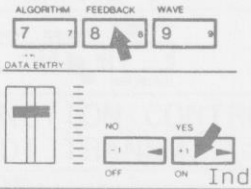
No. 8 MIDI

No. 8 has no indication corresponding to FUNCTION CONTROL MODE. This switch selects channels for MIDI and other such information exchange.

a. MIDI CHANNEL

If switch No. 8 is pushed, the MIDI reception channel is indicated. This can be changed up to 16 by DATA ENTRY (Fig.2/47). For a musical performance using several DXs in tandem, the reception must be set to Channel 1.

Fig.2/47



Indication

FUNCTION CONTROL
MIDI CH=1

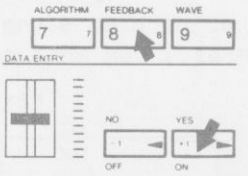
FUNCTION CONTROL
MIDI CH=16

b. SYSTEM INFORMATION

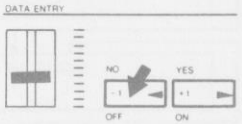
If switch No. 8 is pushed once more after making sure of the indication of the MIDI channel, the indication of SYSTEM INFORMATION AVAIL or UNAVAIL appears (fig.2/48). Switching of AVAIL or UNAVAIL is executed by DATA ENTRY. In UNAVAIL, the following realtime information is exchanged between the DX and the device connected by MIDI:-

Information concerning ON and OFF of any key
PITCH BEND information
Programme change information
Realtime Modulation information such as AFTER TOUCH, BREATH CONTROL, WHEEL CONTROL, etc.
ON and OFF information concerning SUSTAIN PEDAL.

Fig.2/48



FUNCTION CONTROL
SYS INFO AVAIL



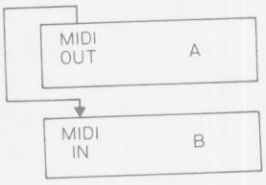
FUNCTION CONTROL
SYS INFO UNAVAIL

In the case above it is possible to exchange such realtime information with any device which has a MIDI terminal. On the other hand, in AVAIL, the DX exchanges the following non-realtime information (i.e. SYSTEM INFORMATION) with devices connected by MIDI (in this case devices connected by MIDI must be digital which have basically the same system as the DX).

* Tone colour data	Exchange of a tone colour Exchange of all 32 colours in a tone block Exchange of a parameter in a tone colour

* Parameter of FUNCTION CONTROL; Exchange of control parameters.

Fig.2/49



c. CONNECTION OF TWO DX-7s

The following is based on two DX's having been connected by MIDI terminal.

UNAVAIL

When the Reception Channel of B is set to 1, connecting two DX's by MIDI terminal as shown in Fig.2/49, the DX-B can be controlled by the DX-A (as MIDI OUT of DX-7 is set to Channel 1, the receiver DX must be set to 1).

If SYSTEM INFORMATION is UNAVAIL, the realtime information of the performance is transferred from the DX-A to the DX-B. If the same tone colour is set in both A and B, the timing shifted slightly and the outputs of A and B are in stereo, a very thick sound will result.

It is also interesting to generate a different tone colour in each. A unique effect is obtained if the PITCH BEND amplitude of A and B is shifted a little or if one DX is switched to MONOPHONIC MODE.

COMBINATION OF POLYPHONIC MODE AND MONOPHONIC MODE

Now, suppose that the Electric Piano in POLYPHONIC MODE is INTERNAL 1 on DX-A and the Flute, in MONOPHONIC MODE, is INTERNAL 1 on DX-B, it will be enhanced if a little FINGERED PORTAMENTO is used. If played normally, a unison of Electric Piano and the Flute is produced, but in MONOPHONIC MODE of the DX, a certain range of tones may be eliminated depending upon the method of playing (Refer to No. 2 POLY and MONO). Thus the effect (unison, piano or both) will depend upon the playing technique used.

When DX-A is connected to B, sounds also come from DX-B. Not only can B be played alone, but also A and B together. In this case, if 6 keys for instance are ON on DX-A, the number of sounds able to be produced on the DX-B decreases to 10.

Note: When used by two DX's in this state,

(a) Exchange information is not transferred to (or from) each MODE.

(b) Volume control for each DX must be provided by the volume pedal from each.

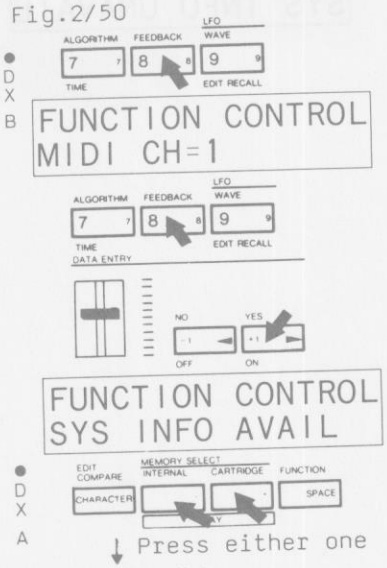
AVAIL

The DX is capable of sending out or receiving tone colour data.

(1) Send tone colour data from DX-A to DX-B(Fig.2/50).

(a) Set MIDI channel of the DX-B to 1 and set to SYSTEM INFORMATION AVAIL.

Fig.2/50



(b) Select a tone colour on the DX-A. This is the same operation as in the case of PLAY MODE. For instance, to send tone colour data of BRASS 1 of INTERNAL, push INTERNAL of MEMORY SELECT and then switch No. 1). By this, the data sent out from DX-A is sent to the EDIT BUFFER. The DX-B goes into EDIT MODE automatically.

(2) Send data concerning all the 32 tone colours from DX-A to DX-B (Fig.2/51).

(a) Set MIDI CHANNEL of the DX-B and set to SYSTEM INFORMATION/AVAIL.

(b) Release MEMORY PROTECT (INTERNAL) of DX-B.

(c) Push No. 8 on DX-A.

(d) Answer YES to "MIDI TRANSMIT?" By this, the data on all 32 tone colours of DX-A are sent to DX-B at once. The data are indirectly written into the 32 memories of INTERNAL on DX-B.

(3) Send only one datum in EDIT MODE or FUNCTION MODE from DX-A to DX-B (Fig.2/52).

(a) Set MIDI CHANNEL of B to 1 and set to SYSTEM INFORMATION AVAIL.

(b) Designate the data to be sent by the DX-A (for instance to send data concerning the Algorithm it is only necessary to change EDIT MODE and push switch NO. 7).

Fig.2/51

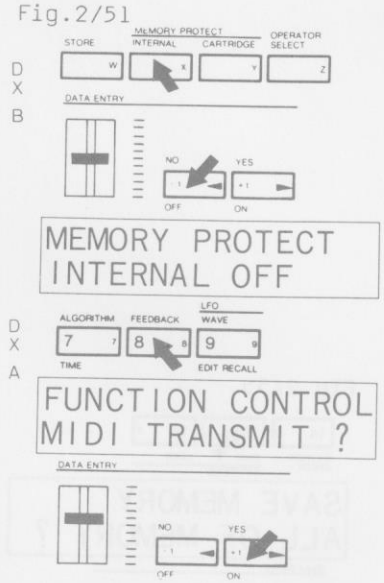
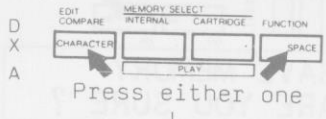


Fig.2/52

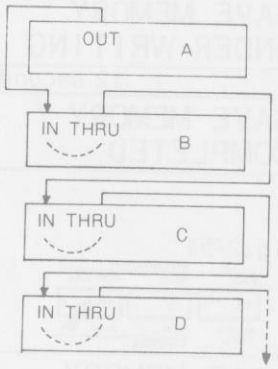


To designate data to be sent by switches from No. 1 to No. 32

d. CONNECTION OF MORE THAN THREE DXs

To connect more than three DX's by MIDI terminal, do as shown in Fig.2/53. For all units except the DX-A, the THRU terminal is used, not the OUT terminal. The THRU terminal is the one which sends out the information which it receives. The figure shows that it is the DX-A which controls all the other DX's, B, C, D etc. In this way as many DX's as desired may be connected (as for the connection with KX, refer to item KX1).

Fig.2/53



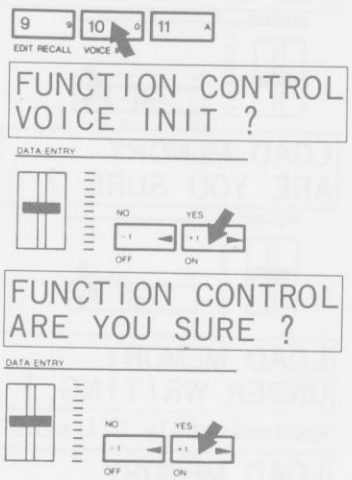
No. 9 EDIT RECALL

For details, see Chapter 1 'TO STORE TONE COLOURS'. EDIT RECALL is used to recall EDIT DATA entered in the BUFFER for standby to EDIT BUFFER.

No. 10 VOICE INITIALIZE

This switch is used to call out INITIAL DATA (the most basic data) prepared inside the DX, to EDIT BUFFER. Answer YES twice at the same time with EDIT RECALL for INITIAL DATA (Fig.2/54). This is used when starting to make a sound from scratch. The contents of INITIAL DATA and its use in making sounds are detailed in Chapter 3.

Fig.2/54



Initial data

No. 11 CARTRIDGE FORM

This writes down the data above in the MEMORY BANK inside the RAM CARTRIDGE. Take care not to erase important data by answering YES carelessly.

No. 12 and 13

No operational function.

No. 14 BATTERY CHECK

This is to check the battery used to stabilize MEMORY. There is no need to change the battery for at least 5 years. If a change is required, a warning sign is indicated.

No. 15 SAVE

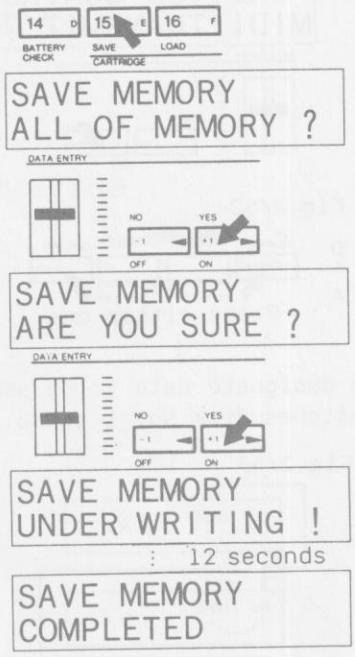
This writes the data held in the main unit concerning the 32 tone colours into the inserted RAM cartridge. This is done by Block Transfer.

To SAVE, release MEMORY PROTECT CARTRIDGE in the main body and also MEMORY PROTECT of RAM itself. The procedure, after all the protects are released, is as follows (Fig.2/55):

(a) Answer 'YES' to the question: 'SAVE MEMORY ALL OF MEMORY?'
(b) Answer 'YES' to the question 'ARE YOU SURE?'
(c) Wait until the indication 'UNDER WRITING!' changes (about ten seconds)

NB: If the cartridge is pulled out and the DX is switched to another mode, writing is stopped. Make sure the word 'COMPLETED' appears. If the cartridge is not inserted, NOT READY INSERT CARTRIDGE appears.

Fig.2/55



No. 16 LOAD

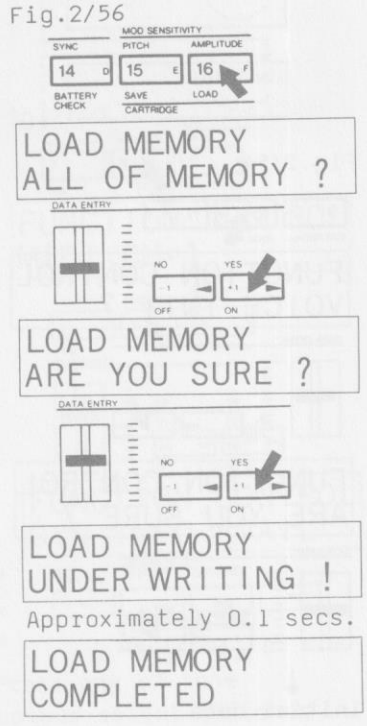
This writes down, by Block Transfer, all the data of RAM CARTRIDGE and ROM CARTRIDGE to the memory of the main unit.

Operate as follows after PROTECT of INTERNAL is OFF (Fig.2/56).

(a) Answer 'YES' to the question 'LOAD MEMORY ALL OF MEMORY?'
(b) Answer 'YES' to the question 'ARE YOU SURE?'
(c) Wait until the indication 'UNDER WRITING!' is changed to 'COMPLETED' (Load is completed almost instantaneously).

Note: It is important to understand clearly the difference between RAM and ROM, and between SAVE and LOAD.

Fig.2/56



RAM ... Random Access Memory
This is the memory into or from which DATA can be freely saved or loaded.
ROM ... Read Only Memory
DATA cannot be saved in this Memory. It can be used only for loading from.
SAVE ...INSIDE MEMORY → OUTSIDE MEMORY
LOAD ...INSIDE MEMORY ← OUTSIDE MEMORY

The following switches from No. 17 to 32 are in groups of four -

No. 17 - 20 ... Control of Modulation by Wheel.
No. 21 - 24 ... Control of Modulation by Breath Controller.
No. 25 - 28 ... Control of Modulation by Foot Controller.
No. 29 - 32 ... Control of Modulation by After Touch.

No. 17 WHEEL RANGE

This decides the work load of Wheel by dividing it into 100 ranges from 0 to 99. When WHEEL RANGE is 0, work load is 0, i.e. WHEEL does not work. When WHEEL RANGE is 99, WHEEL works at its maximum.

No. 18 WHEEL PITCH

This chooses whether to set PM by WHEEL. Setting ON or OFF is done by DATA ENTRY. When it is ON, the depth of PM by WHEEL may be controlled. PM is set in the following way:
(a) PITCH MODULATION SENSITIVITY (0 - 7) of thechosen tonecolouris greater than 0 (Switch No.15 of EDIT MODE decides this).
(b) WHEEL RANGE (0 - 99) is greater than 0.
(c) WHEEL PITCH = ON.

No. 19 WHEEL AMP

This chooses whether to set AM by WHEEL. It is set ON or OFF by DATA ENTRY. When it is ON, the depth of AM by WHEEL may be controlled, but remember there are TREMOLO and WOW in the AM of the DX. TREMOLO by WHEEL is set in the following way:
(a) AMPLITUDE MODULATION SENSITIVITY of chosen tone colour in the operator of Carrier (0 - 3) is greater than 0 (switch No. 16 of EDIT MODE decides this).
(b) WHEEL RANGE is greater than 0.
(c) WHEEL AMP = ON.

WOW by WHEEL is set in the following way:

(a) AMPLITUDE MODULATION SENSITIVITY of the chosen tone colour in the operator of Modulator (0 - 3) is greater than 0 (switch 16 EDIT MODE decides this).
(b) WHEEL RANGE is greater than 0.
(c) WHEEL AMP = ON.

No. 20 WHEEL EG BIAS.

This controls the setting of EG BIAS by WHEEL. It is set ON or OFF by DATA ENTRY. When it is ON, it controls the sound volume and brilliance of tone colour by WHEEL.
Control of sound volume is carried out as follows:
(a) AMPLITUDE MODULATION SENSITIVITY of the chosen tone colour in the operator of Carrier (0 - 3) > 0 (switch No. 16 of EDIT MODE decides this).
(b) WHEEL RANGE > 0.
(c) WHEEL EG BIAS = ON.

Control of tone colour by WHEEL is done as follows:

(a) AMPLITUDE MODULATION SENSITIVITY of the chosen tone colour in the Operator of the Modulator (0 - 3) > 0 (Switch No. 16 of EDIT MODE decides this).
(b) WHEEL RANGE > 0.
(c) WHEEL EG BIAS = ON.

What is EG BIAS?

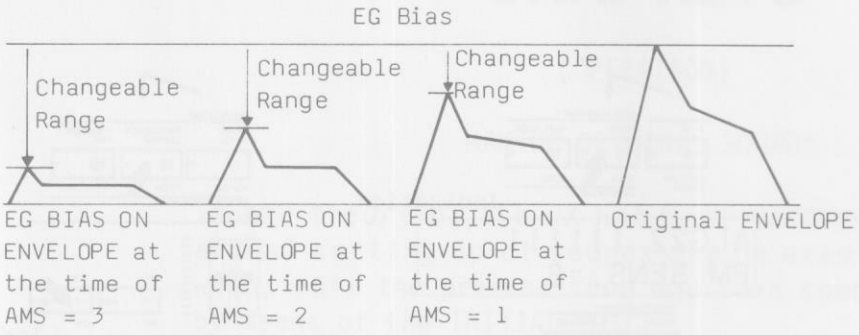
EG BIAS by the DX is a negative voltage which affects the level of the ENVELOPE.
To try the effect of an actual test on the DX, set as follows:

(a) Select BRASS 1 of INTERNAL 1, change to EDIT MODE and push switch No. 16.
(b) Set AM SENS of OP1,OP3,OP4 and OP5 of Carrier No. 3.
(c) Change to FUNCTION MODE and push Switch No. 17 and set WHEEL RANGE to 99.
(d) Push Switch No. 20 and set WHEEL EG BIAS to ON.

After these are set, hardly any sound is heard when the WHEEL is low. This means that MINUS power is added to the ENVELOPE and the ENVELOPE is small (RATE is not changed).

But if the WHEEL is up, the ENVELOPE goes back to the original size, and sound comes out again (Fig. 2/57). It is AM SENS that decides the size of MINUS power added to ENVELOPE.

Fig.2/57



When AM SENS of the Carrier operator is up, sound volume changes, but when AM SENS of the modulator operator is up, the depth of modulation by WHEEL changes, so tone colour changes.

Up to now, items 17 to 20, modulation control by WHEEL has been explained. FOOT CONTROL, BREATH CONTROL and AFTER TOUCH are the same, and their details have been omitted except for the following:

When EG BIAS is set by the BREATH CONTROLLER, it is possible to control tone colour and volume freely by breath and to obtain a very high expressive power.

AFTER TOUCH of the DX-7 is common to all the keys. For instance, when some keys are ON, it is impossible to set AFTER TOUCH VIBRATO to only one key (it is possible on the DX1).

NO. 21 SETTING EXERCISE

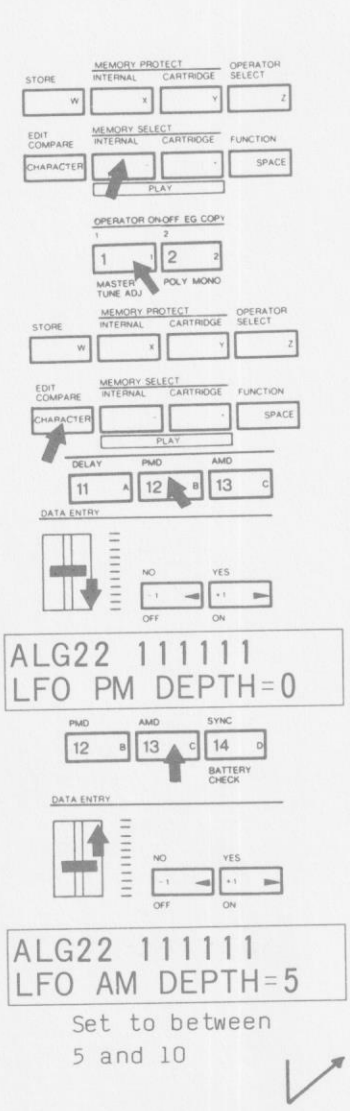
Try some settings using BRASS 1. Try to do this looking at this book as little as possible.

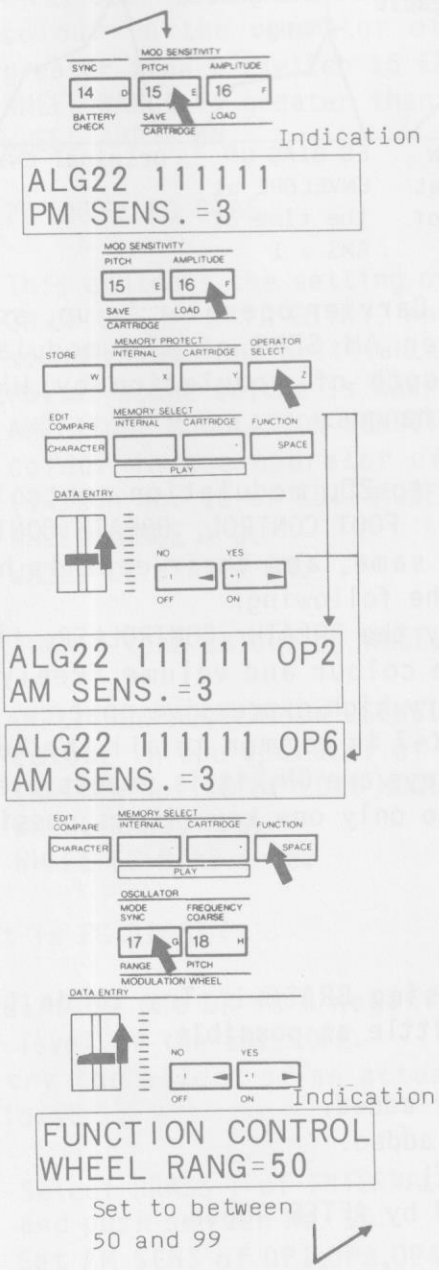
(a) Preset WOW is slightly added.
(b) Preset VIBRATO is not added.
(c) Vibrato is set by WHEEL.
(d) Tone colour is changed by AFTER TOUCH.

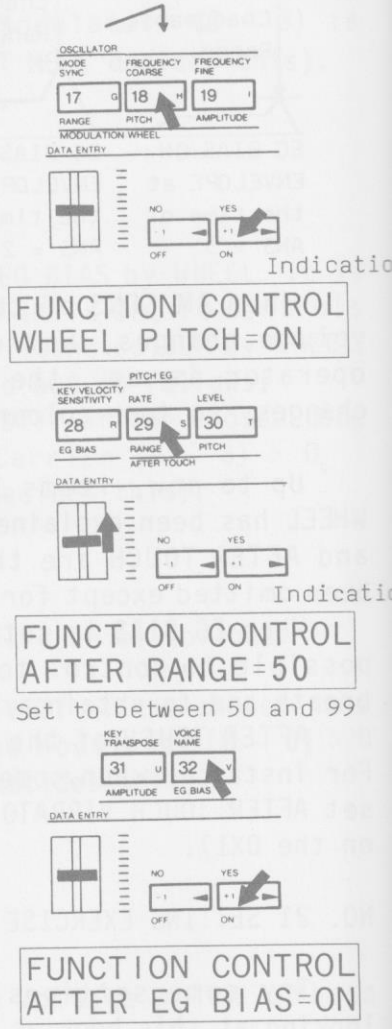
OPERATION PROCEDURE (Fig. 2/58).

(a) Set BRASS 1 to EDIT MODE.
(b) Set No. 12 PMD to 0.
(c) Set No. 13 AMD to about 5 or 10.
(d) Set No. 15 PM SENS to over 0.
(e) Set No. 16 AM SENS to OP2 and OP6 and set to 3 (set all others OPs to 0).
(f) Set to FUNCTION MODE.
(g) Set No. 17 WHEEL RANGE to between 50 and 99.
(h) Set No. WHEEL PITCH to ON.
(i) Set No. 29 AFTER RANGE to between 50 and 99.
(j) Set No. 32 AFTER EG BIAS to ON.

Fig.2/58


STORE
MEMORY PROTECT
INTERNAL
CARTRIDGE
OPERATOR SELECT
EDIT COMPARE
MEMORY SELECT
CHARACTER
FUNCTION
SPACE
PLAY
OPERATOR ON-OFF EG COPY
MASTER TUNE ADJ
POLY MONO
DELAY
PMD
AMD
DATA ENTRY
NO
YES
OFF
ON
ALG22 111111
LFO PM DEPTH=0
SYNC
BATTERY CHECK
ALG22 111111
LFO AM DEPTH=5
Set to between
5 and 10


MOD SENSITIVITY
PITCH
AMPLITUDE
BATTERY CHECK
SAVE
LOAD
CARTRIDGE
Indication
ALG22 111111
PM SENS.=3
ALG22 111111 OP2
AM SENS.=3
ALG22 111111 OP6
AM SENS.=3
OSCILLATOR
MODE SYNC
FREQUENCY COARSE
RANGE
MODULATION WHEEL
FUNCTION CONTROL
WHEEL RANG=50
Set to between
50 and 99
Indication


OSCILLATOR
MODE SYNC
FREQUENCY COARSE
FREQUENCY FINE
RANGE
PITCH
AMPLITUDE
MODULATION WHEEL
DATA ENTRY
NO
YES
OFF
ON
Indicatio
FUNCTION CONTROL
WHEEL PITCH=ON
PITCH EG
KEY VELOCITY SENSITIVITY
RATE
LEVEL
EG BIAS
RANGE
AFTER TOUCH
Indicati
FUNCTION CONTROL
AFTER RANGE=50
Set to between 50 and 99
KEY TRANSPOSE
VOICE NAME
FUNCTION CONTROL
AFTER EG BIAS=ON

CHAPTER 3

(OPERATION)

MAKING ORIGINAL SOUNDS

If the theory of the DX has been mastered so far, the actual setting up of sounds can be examined. To begin with, edit the present tone and then compose new tones by means of the INITIAL VOICE.

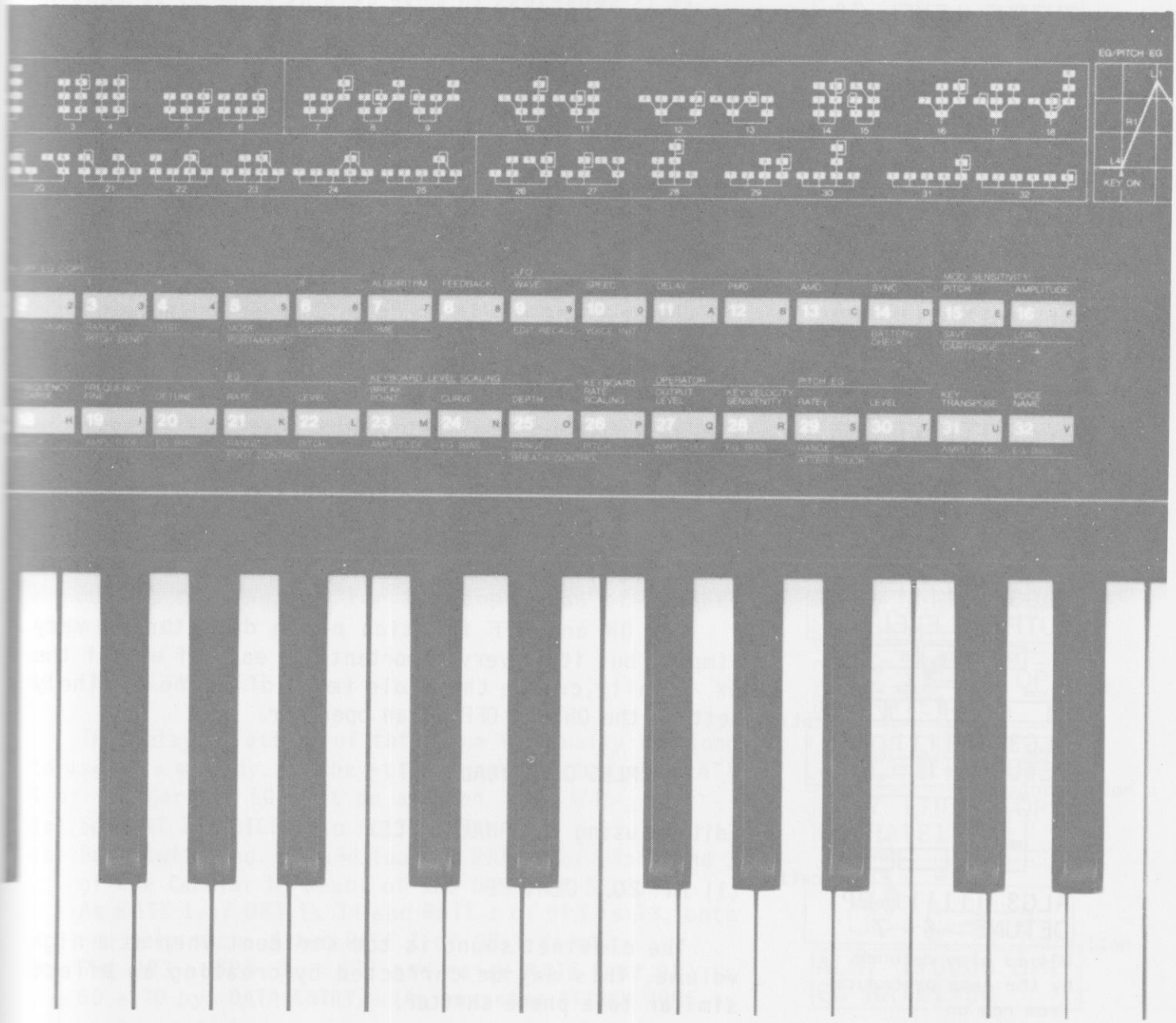


Fig.3/1

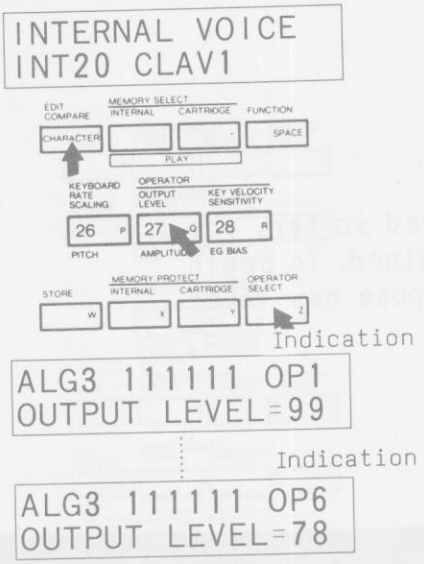
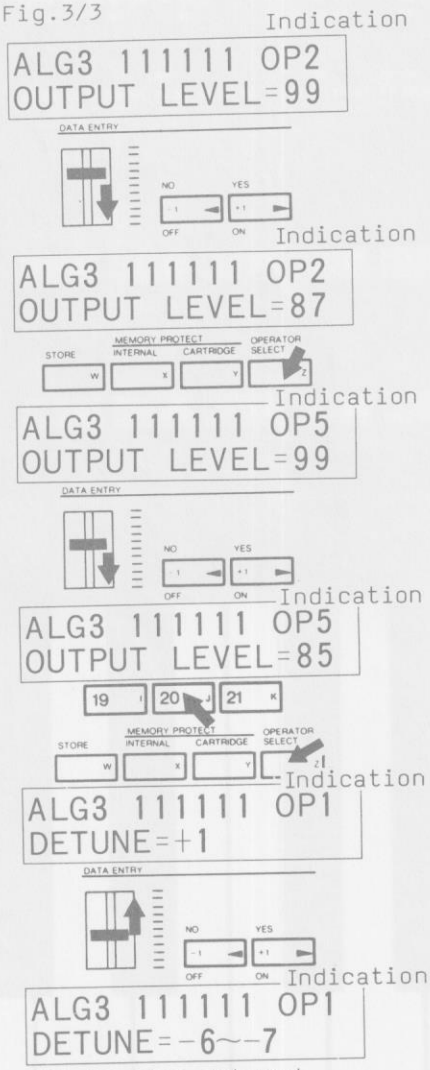


Fig.3/3



OP4 is also detuned by the same procedure from now on

1. SECRET OF EDIT

The simplest way to make an original sound is to EDIT a pre-prepared tone colour.

(a) HAVE A CONCRETE AND DEFINITE PURPOSE, WANTING TO CHANGE A SOUND IN A PARTICULAR WAY.

A vague feeling is of no use in EDITING. The essential thing is to be clear as to where and how the sound is to be changed.

(b) DECIDE WHAT DATA MUST BE CHANGED IN ORDER TO GET THE REQUIRED SOUNDS.

It is senseless to move data at random. It must be moved as rationally as possible, using total knowledge. There are some standard EDITS, which are as follows:

(c) Change OUTPUT LEVEL of a Modulator in order to correct a tone colour that is too mild.
(d) Change FEEDBACK LEVEL to correct a tone colour that lacks character, is chirpy, too crisp, etc.
(e) Change EG RATE 1 to correct tones which start too late, too fast etc. Note the difference between the Carrier and the Modulator.
(f) Change EG RATE 4 in order to correct a tone which is inarticulate, too staccato, etc. Change both the Carrier and the Modulator.
(g) Change DETUNE to increase or decrease swell.

The above are the most common cases. It is possible to solve about 90% of tone colour problems by the five EDIT procedures above.

(3) USE ON & OFF FUNCTIONS OPERATOR OR EDIT COMPARE MODE IN ORDER TO FACILITATE EDITING.

The ON and OFF function of an operator is very simple, but it is very important for ease of use of the DX. Finally,create the whole image of a tone by finely setting the ON and OFF of an operator.

2. EXAMPLES OF ACTUAL EDIT

Editing using INTERNAL VOICE.

(1) INT 20. CLAV 1

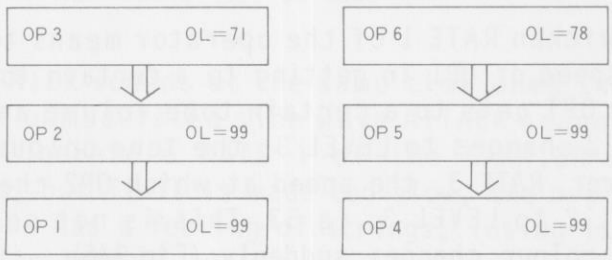
The clavinet sound is too strident when at a high volume. This may be corrected by creating an effect similar to a phase shifter.

To change the whole tone colour it is only necessary to change the output level of the modulator. Use detune to get an effect like a phase shifter.

(Fig.3/1)
(a) Set INT 20 CLAV 1 to EDIT MODE.
(b) Push No.27 and look at OUTPUT LEVEL of each operator by means of OPERATOR SELECT.

Since the Algorithm of this tone is No. 3, the combination of each operator is as shown in Fig. 3/2.
Note that the OUTPUT LEVEL of OP 2 and OP5, which are directly modulating OP1 and OP4, are both 99 and very high.

Fig.3/2



Continue as follows (Fig.3/3).
(c) Lower OUTPUT LEVELs of OP2 and OP5 by means of DATA ENTRY. Lower both of them between 6 and 14 according to personal taste. (If it is lowered too much, the tone will become muffled). The metallic sound will now disappear.
(d) Push switch No.20 and put DETUNE in OP1 and OP4, using DATA ENTRY.
When OP1 is -6 or -7 and OP4 is +6 or +7, the shuwa-shuwa effect deepens and the tone colour assumes a rounded feeling. As for the amplitude of DETUNE, adjust as desired.

(2) INT 30. VOICE 1

The delay of attack of this tone is usually too long to use as a melody. As the attack rate is changed, RATE 1 of the Carrier EG must be altered. (Fig.3/4).
(a) Set INT 30 VOICE 1 to EDIT MODE.
(b) Push switch No. 21 and look at RATE 1 of OPs 1 and 3 of the Carrier by means of the OPERATOR SELECT.
As RATE 1 of OP1 is 34 and RATE 1 of OP3 is 33, both are very slow. Alter RATE 1 of OP 1 first.
(c) Set OP3 - OP6 to OFF and raise RATE 1 of OP1 to 60 - 70 by DATA ENTRY. (An unwanted ATTACK TONE is

Fig.3/4

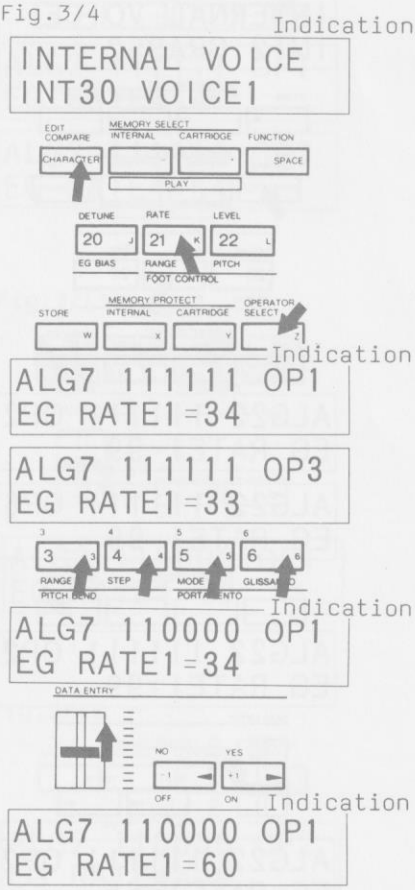


Fig.3/6

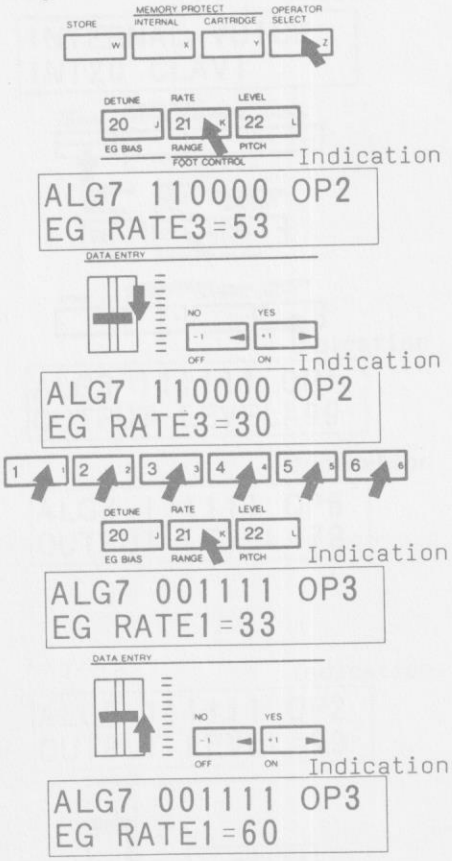
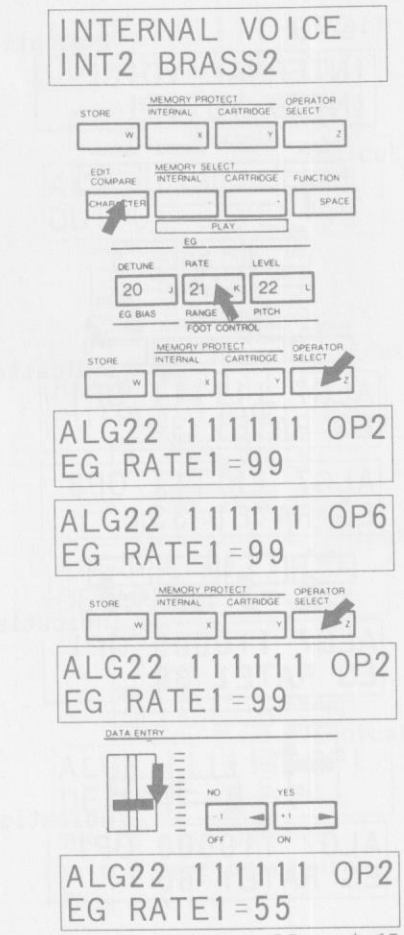
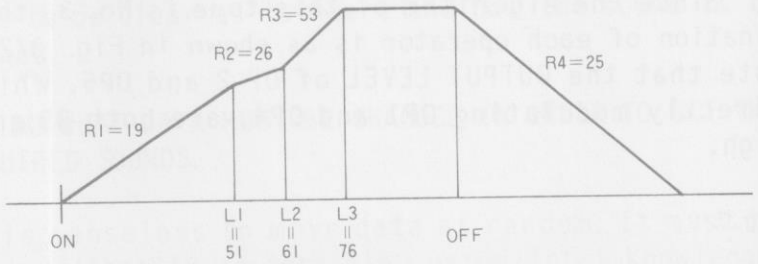


Fig.3/7



generated by OP1 if it is raised too much). This procedure may be sufficient but there may be some change in tone colour, like that of brass. This is caused by the ENVELOPE of the MODULATOR OP2. The ENVELOPE of OP2 is as shown in Fig.3/5.

Fig.3/5



To quicken RATE 1 of the operator means to quicken the speed of OP1 in getting to a certain tone volume. When OP1 gets to a certain tone volume and LEVEL 2 of OP2 changes to LEVEL 3, the tone colour becomes clearer. RATE 3, the speed at which OP2 changes from LEVEL 2 to LEVEL 3, is 53. This is not so slow, so tone colour changes suddenly (Fig.3/6).

(d) Lower RATE 3 of OP2 to about 30 by means of DATA ENTRY. After a key is played, the change of tone colour begins slowly and the brass sound disappears.

(e) Set OP1 and OP2 to OFF, and set OP3, OP4, OP5 and OP6 to ON, and then raise RATE 1 of OP3 to about 60 or 65. Modulators OP 4 - 6 have no LEVEL SETTING for rising tones, as does OP2, so it is enough to increase RATE 1 of only OP3.

(f) Set all the operators to ON and get the feeling of the atmosphere it creates.

(3) INT. 2 BRASS 2

This tone is very full of life, but to add a little of the feeling of brass, change the tone colour at the time of ATTACK.

As the attack must be changed, adjust RATE 1 of the Modulator's EG. (Fig.3/7)

(a) Set INT 2 BRASS 2 to EDIT MODE.

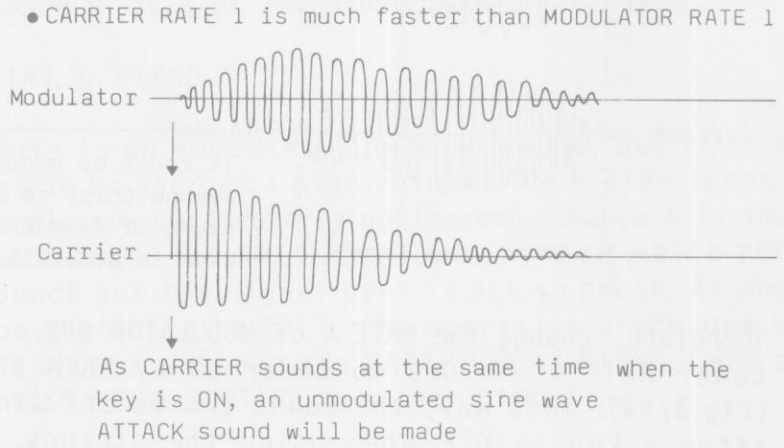
(b) Push switch No. 21 and look at RATE 1 of OP2 and OP6 using OPERATOR SELECT. RATE 1 of OP2 and OP6 of the MODULATOR is now 99, the highest speed.

(c) Lower RATE 1 of OP2 and OP6 to between 55 and 65 using DATA ENTRY.
When a key is ON, and played, the sine wave ATTACK TONE is heard. This is an unmodulated tone as shown in Fig.3/8 since the rate 1's of CARRIERS OP1, OP3,

 Same procedure from now on

OP4 and OP5 are faster than those of the MODULATORS OP2 and OP6.

Fig.3/8



As CARRIER sounds at the same time when the key is ON, an unmodulated sine wave ATTACK sound will be made. Therefore RATE 1 of the CARRIER must be slowed, but if it is made too slow, the beginning of the tone has a feeling of strings, losing its sharp, metallic tone.

(d) Slow RATE 1 of OP1,OP3,OP4 and OP5 to between 70 and 80 (Fig.3/9).

(4) INT.4 STRINGS 1

In order to change the decay time, RATE 4 of the Carrier must be adjusted (Fig.3/10).

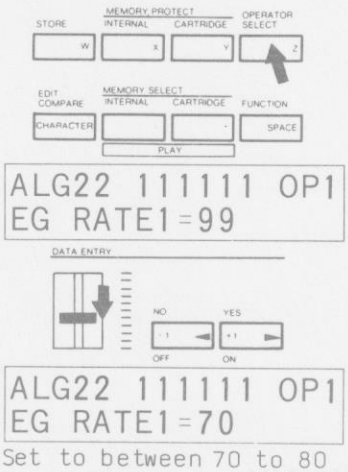
(a) Change INT.4 STRINGS 1 to EDIT MODE.

(b) Push Switch No. 21 and look at RATE 4 of the Carrier's OP1 and OP3 by OPERATOR SELECT. RATE 4 of OP1 is 41 and RATE 4 of OP3 is 54. The latter, 54, is not slow at all, but the tone of the former, 41, trails off comparatively soon after the key is off. Examine the reason for this.

(c) Set OP3 - OP6 to OFF, and slow RATE 4 of OP1 to 30 by DATA ENTRY (Fig.3/11). In this way the decay time may be lengthened but the trailing sound is that of sine wave and is unmodulated.

(d) Look at RATE 4 of OP2 by OPERATOR SELECT (Fig.3/12). RATE 4 of OP2 is now 49, which is faster than RATE 4 of OP1. This means that after a key is released, MODULATION ends before the tone volume has finished lowering. So there remains only the sound of the unmodulated sine wave (Fig.3/13).

Fig.3/9



Set to between 70 to 80
Same procedure from now on

Fig.3/10

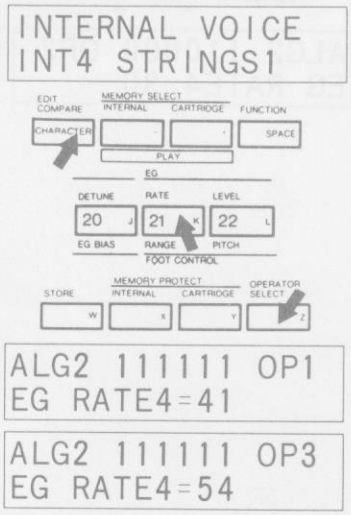


Fig.3/11

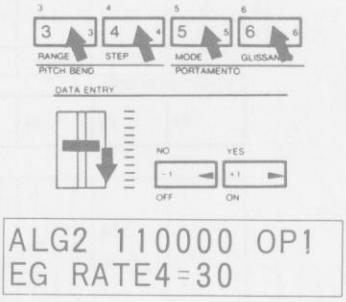


Fig.3/12

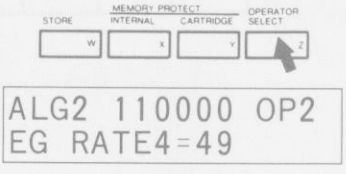


Fig.3/13

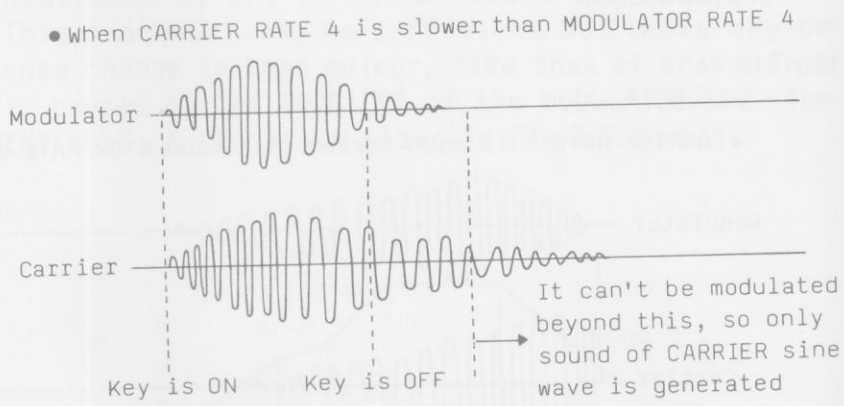
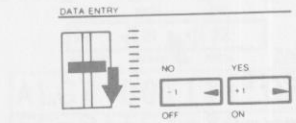


Fig.3/14



ALG2 110000 OP2
EG RATE4=30

Therefore, change the RATE 4 of MODULATOR OP2.

(e) Lower RATE 4 of OP2 to under 30 by DATA ENTRY (Fig.3/14). This way, the sound trails off slowly after a key is OFF when using the strings. The reason is that the speed of finishing modulation is slower than the trailing off of sound volume.

Accordingly, the relation between RATE 4 of the MODULATOR and RATE 4 of the CARRIER is summarized as follows:

(i) RATE4ofthe CARRIER < RATE4ofthe MODULATOR
... After the key is released, MODULATION finishes first and only the sound of the unmodulated sine wave remains. After the key is OFF, the change of tone colour appears clear.

(ii) RATE 4 of CARRIER = RATE 4 of MODULATOR
... After the key is OFF, tone volume becomes 0 at the same time MODULATION ends, i.e. the changes of tone colour and volume go on at the same time.

(iii) RATE 4 of CARRIER > RATE 4 of MODULATOR
... After the key is OFF, the change of tone volume finishes first. Therefore, the larger the difference between the two, the faster the tone volume trails off when being modulated. Thus the change in tone colour is not heard.

Note: The RATE of the DX is always decided relative to LEVEL. When LEVEL 3's of both (the level which RATE 4 starts) are different even if their RATE 4's are equal on the indicator, the time of RATE 4 becomes basically different.

For instance, when LEVEL 3 of CARRIER is 90, LEVEL 3 of MODULATOR is 45 and RATE 4's of both are 40, practical time of RATE 4 = 45 from LEVEL 3 = 90, is twice that of RATE 4 = 45 from LEVEL 3 = 45. Therefore, the LEVEL 3's of the two are different, and it is necessary to increase the value of RATE 4 on the INDICATOR so that the execution time of both may agree.

As mentioned above, in order to lengthen the time for volume change after a key is OFF as well as for STRINGS 1 it is necessary that RATE 4 of the CARRIER should be slowed as much as required, and that RATE 4 of the MODULATOR should be the same as the value on the INDICATOR (RATE 4 of the slowed CARRIER or less).

(5) INT. 9, PIANO 2

This is an immensely powerful sound, but it is too coarse to be used at a high volume. The higher tones on the scale are particularly unpleasant. Change this sound to PIANO SOUND for ROCK, the lower part of which still has punch but the higher part is not so brash. As there is too much data to EDIT, the operation procedure has been omitted and only the DATA LIST of PIANO 2 and the DATA LIST after EDITING have been picked out.

Only actually EDITED DATA is shown below.Other data are not required.

Examine the DATA LIST and carry out the EDIT operation. Make sure which part of the data change is important. (Fig.3/15 - a and b).

FREQUENCY FINE and PITCH EG DATA are omitted

Fig.3/15a

FREQUENCY FINE and PITCH EG DATA are omitted

DATE/PRESET No. : /

VOICE NAME : Piano 2

PROGRAMMER :

ALGO-RITHM	FEED-BACK	LFO WAVE	LFO SPEED	LFO DELAY	LFO PMD	LFO AMD	LFO SYNC	MOD. SENSITIVITY PITCH	MOD. SENSITIVITY AMPLITUDE	OP
18	5	TRIANGLE	30	0	0	0	OFF	4	0	6
									0	5
									0	4
									0	3
									0	2
									0	1
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

OP	MODE/SYNC	FREQ. COARSE	FREQ. FINE	DETUNE	EG RATE 1	EG RATE 2	EG RATE 3	EG RATE 4	EG LEVEL 1	EG LEVEL 2	EG LEVEL 3	EG LEVEL 4	BREAK POINT	KEYBOARD LEVEL SCALING CURVE L	CURVE R	DEPTH L	DEPTH R	K.BOARD RATE SCALING	OUTPUT LEVEL	VELOCITY SENS.	PITCH EG RATE 1	PITCH EG RATE 2	PITCH EG RATE 3	PITCH EG RATE 4	PITCH EG LEVEL 1	PITCH EG LEVEL 2	PITCH EG LEVEL 3	PITCH EG LEVEL 4	KEY TRANSPOSE	VOICE NAME
6	Ratio	0.50		+1	92	71	58	36	99	0	0	0	A2	-L	-L	0	98	3	78	1									MC	
5	Ratio	0.50		0	90	71	33	31	99	0	0	0	C2	+E	-L	0	26	3	94	1									= C2	
4	Ratio	1.00		-1	97	27	10	25	99	36	48	0	A-1	-L	-L	0	0	3	84	1										
3	Ratio	5.00		+1	90	27	20	50	99	85	0	0	F2	-L	-L	0	27	5	83	1										
2	Ratio	1.00		+2	95	02	50	99	75	0	0	0	A-1	-L	-L	0	10	2	86	1										
1	Ratio	1.00		0	80	24	10	50	99	62	0	0	A-1	-L	-L	0	0	3	96	2										
	OFF																													
	OSCILLATOR				EG RATE				EG LEVEL				KEYBOARD LEVEL SCALING						OPERATOR		PITCH EG RATE				PITCH EG LEVEL					
17	18	19	20	21					22				23	24		25		26	27	28	29				30				31	32

Fig.3/15b

Only EDITED DATA have been written down

DATE/PRESET No. : /

VOICE NAME : New Piano

PROGRAMMER : Yasuhiko Fukuda

	ALGORITHM	FEEDBACK	LFO WAVE	LFO SPEED	LFO DELAY	LFO PMD	LFO AMD	LFO SYNC	MOD. SENSITIVITY PITCH	MOD. SENSITIVITY AMPLITUDE
	1	2	3	4	5	6	7	8	9	10

OP	MODE/SYNC	FREQ. COARSE	FREQ. FINE	DETUNE	EG RATE 1	EG RATE 2	EG RATE 3	EG RATE 4	EG LEVEL 1	EG LEVEL 2	EG LEVEL 3	EG LEVEL 4	KEYBOARD LEVEL SCALING BREAK POINT	KEYBOARD LEVEL SCALING L CURVE	KEYBOARD LEVEL SCALING R CURVE	KEYBOARD LEVEL SCALING L DEPTH	KEYBOARD LEVEL SCALING R DEPTH	K.BOARD RATE SCALING	OPERATOR OUTPUT LEVEL	OPERATOR VELOCITY SENS.	PITCH EG RATE 1	PITCH EG RATE 2	PITCH EG RATE 3	PITCH EG RATE 4	PITCH EG LEVEL 1	PITCH EG LEVEL 2	PITCH EG LEVEL 3	PITCH EG LEVEL 4	KEY TRANSPOSE	VOICE NAME
6					20								D3			47	90		80	2										
5					30	5			30	15			C3	-E		45			80	2										
4													B2				55		80	2										
3		4.00			25	47			8	70			D3	+L		8	65		78	5									C3	
2					8	9			25	5									99											
1					25	5				10																				
	OSCILLATOR				EG								KEYBOARD LEVEL SCALING						OPERATOR		PITCH EG									
	17	18	19	20	21	22							23	24		25		26	27	28	29								31	32

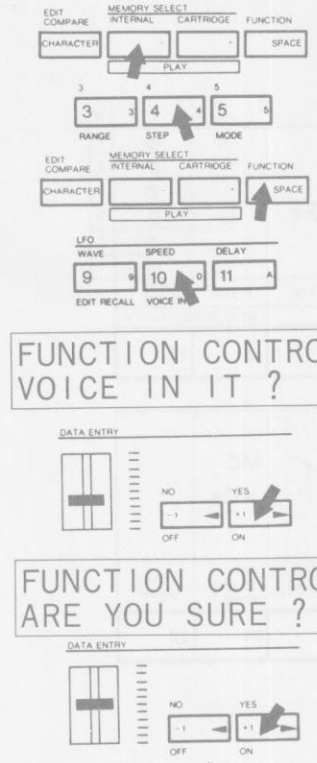
3. CREATING SOUNDS IN INITIAL VOICE

The best way to create sounds on the DX is to use INITIAL VOICE, which is almost blank as far as data is concerned.

(1) CREATING ELECTRIC PIANO FROM INITIAL VOICE

(a) Initialize Voice (Fig.3/16).

Fig.3/16



(i) Change to FUNCTION MODE.
(ii) Push switch No. 10.
(iii) Answer YES to 'VOICE INIT?'
(iv) Answer YES to 'ARE YOU SURE?'

Data for Initial Voice obtained in this way is shown in Fig.3/17.

When the key is pushed, only the 'sine wave' frequency sound is generated. As in Initial Voice, the OUTPUT LEVELS for all the operators, except OP1, are all 0, and the sound generated is that of the Carrier OP1 by itself.

When the DX is put in INITIAL VOICE, it is already in EDIT MODE, and so no special procedures need be taken in order to begin editing.

Fig.3/17

DATE/PRESET No. : /

VOICE NAME : INTIAL VOICE

PROGRAMMER :

	ALGORITHM	FEEDBACK	WAVE	SPEED	DELAY	PMD	AMD	SYNC	PITCH MOD. SENSITIVITY	AMPLITUDE
	1	0	TRIANGLE	35	0	0	0	ON	3	
OP 6										0
OP 5										0
OP 4										0
OP 3										0
OP 2										0
OP 1										0
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

OP		MODE/SYNC	FREQ. COARSE	FREQ. FINE	DETUNE	EG RATE 1 2 3 4	EG LEVEL 1 2 3 4	BREAK POINT	KEYBOARD LEVEL SCALING CURVE L	CURVE R	DEPTH L	DEPTH R	K.BOARD RATE SCALING	OPERATOR OUTPUT LEVEL	OPERATOR VELOCITY SENS.	PITCH EG RATE 1 2 3 4	PITCH EG LEVEL 1 2 3 4	KEY TRANSPOSE	VOICE NAME
6	Ratio	ON	1.00	1.00	0	99 99 99 99	99 99 99 0	A-1	-L	-L	0	0	0	0	0	99 99 99 99	50 50 50 50	MC = C_3	INIT VOICE
5	Ratio		1.00	1.00	0	99 99 99 99	99 99 99 0	A-1	-L	-L	0	0	0	0	0				
4	Ratio		1.00	1.00	0	99 99 99 99	99 99 99 0	A-1	-L	-L	0	0	0	0	0				
3	Ratio		1.00	1.00	0	99 99 99 99	99 99 99 0	A-1	-L	-L	0	0	0	0	0				
2	Ratio		1.00	1.00	0	99 99 99 99	99 99 99 0	A-1	-L	-L	0	0	0	0	0				
1	Ratio		1.00	1.00	0	99 99 99 99	99 99 99 0	A-1	-L	-L	0	0	0	99	0				
		OSCILLATOR				EG		KEYBOARD LEVEL SCALING						OPERATOR		PITCH EG			
		17	18	19	20	21	22	23	24	25			26	27	28	29		30	31	32

(b) Choose Algorithm (Fig.3/18). Push switch No. 7 and by DATA ENTRY choose ALG3. Use Algorithm No. 3 at first, because it is the easiest type to use for a beginner.

(c) Plan how to produce a certain sound on the basis of a given Algorithm. It is very important to decide a plan and what role each Operator is to play. Even if the results are not good, a clearer idea is gained as to the next type of Algorithm to try (Fig.3/19).

Using OP1, OP2 and OP3, produce the basic sound of the Electric Piano.
Using OP4, OP5 and OP6, produce the striking sound of the Electric Piano.

(d) According to the plan, turn OFF the operators which do not serve any useful purpose. This is very important for creating sounds on the DX. Use only the operators necessary for the operation.
As only OP1, OP2 and OP3 are needed, turn OFF OP4, OP5 and OP6 (Fig.3/20).

(e) Decide the ENVELOPE for OP1 (Fig.3/21).

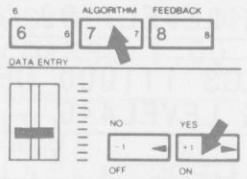
(i) Push No. 21 and, by means of DATA ENTRY, switch from RATE1 to RATE 4.

(ii) Push No. 22 and, by means of DATA ENTRY, switch from LEVEL 1 to LEVEL 4.

The Envelope Data is as follows:

LEVEL 1 = 99	RATE 1 = 95*
LEVEL 2 = 45*	RATE 2 = 35*
LEVEL 3 = 45*	RATE 3 = 99
LEVEL 4 = 0	RATE 4 = 65*

Fig.3/18



ALG3 111111
ALGORITHM SELECT

Fig.3/19

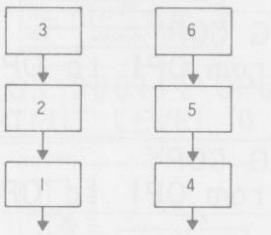
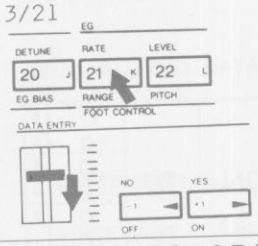


Fig.3/20

ALG3 111000
ALGORITHM SELECT

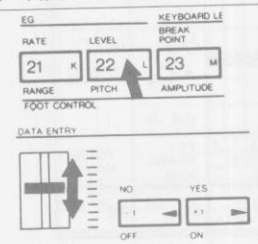
Fig.3/21



ALG3 111000 OP1
EG RATE1=95

⋮

ALG3 111000 OP1
EG RATE4=65

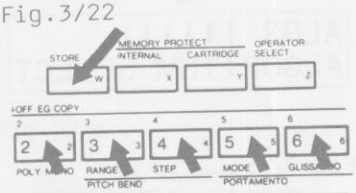


ALG3 111000 OP1
EG LEVEL1=99

⋮

ALG3 111000 OP1
EG LEVEL4=0

Fig.3/22

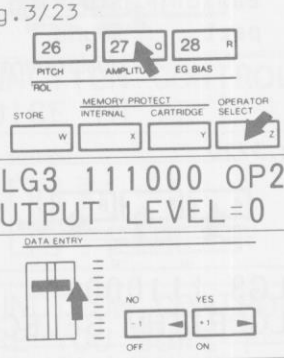


EG COPY
from OP1 to OP2

⋮

EG COPY
from OP1 to OP6

Fig.3/23



ALG3 111000 OP2
OUTPUT LEVEL=0

ALG3 111000 OP2
OUTPUT LEVEL=65

⋮

ALG3 111000 OP2
OUTPUT LEVEL=80

The numerical values marked * may be changed within a range of about + or -4 or 5, according to taste.

When LEVEL 2 is equal to LEVEL 3, RATE 3 can be any number, as was mentioned in Chapter 1. But, for the present, leave it at its INITIAL VOICE setting.

(f) Copy OP1's Envelope DATA to all the other operators (Fig.3/22).
With the STORE switch pushed, push switches No.2, No. 3, No. 4, No. 5 and No. 6.
EG COPY is always done from the operator which was chosen by the OPERATOR SELECT, whether the designated operator is either ON or OFF. If the Envelope Data is transferred to all the operators subsequent operation will be easy.

(g) Decide the OUTPUT LEVEL for OP2 (Fig.3/23).
(i) Push switch No. 27.
(ii) By means of OPERATOR SELECT, select OP2.
(iii) While listening to the sound, by means of DATA ENTRY raise the OUTPUT LEVEL of OP2 little by little (always try to strike not push the key) The OUTPUT LEVEL for OP2 should be set within the range of 65 to 80. It is not desirable to raise OP2 too much in relation to OP1.

(h) Set OUTPUT LEVEL for OP3 (Fig.3/24).
(i) By means of OPERATOR SELECT, select OP3.
(ii) While listening to the sound, by means of DATA ENTRY raise the OUTPUT LEVEL of OP3 within the range of 60 to 80 until the desired sound has been achieved.

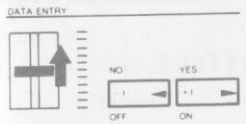
Make a basic tone colour by combining OP1, OP2 and OP3. As their Envelopes are all the same, only the settings of OP2 and OP3 decisively influence a tone's colour.

(i) Exchange the operators (Fig.3/25).
a. Turn OFF OP1, OP2 and OP3.
b. Turn ON OP4, OP5 and OP6.

(j) By means of DATA ENTRY, set the OUTPUT LEVEL of OP4 to 99. The OUTPUT LEVEL of CARRIER may be kept at 99

Fig.3/24

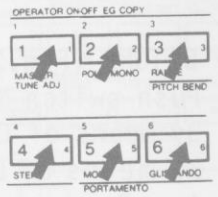
ALG3 111000 OP3
OUTPUT LEVEL=0



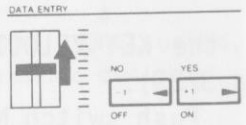
ALG3 111000 OP3
OUTPUT LEVEL=60

ALG3 111000 OP3
OUTPUT LEVEL=80

Fig.3/25

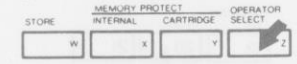


ALG3 000111 OP4
OUTPUT LEVEL=0

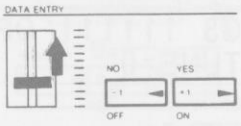


ALG3 000111 OP4
OUTPUT LEVEL=99

Fig.3/26

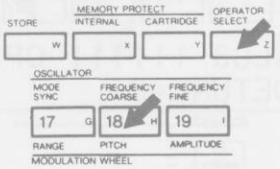


ALG3 000111 OP5
OUTPUT LEVEL=0

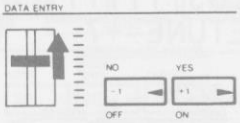


ALG3 000111 OP5
OUTPUT LEVEL=65

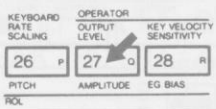
ALG3 000111 OP5
OUTPUT LEVEL=75



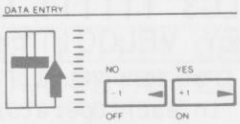
ALG3 000111 OP6
F COARSE=1.00



ALG3 000111 OP6
F COARSE=14.00



ALG3 000111 OP6
OUTPUT LEVEL=0



ALG3 000111 OP6
OUTPUT LEVEL=20

ALG3 000111 OP6
OUTPUT LEVEL=30

If it needs adjustment, it may be done later.

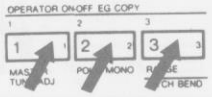
(k) Set the OUTPUT LEVEL for OP5 (Fig.3/26).
  (i) By means of OPERATOR SELECT, select OP5.
  (ii) While listening to the sound, by means of DATA ENTRY raise the OUTPUT LEVEL of OP5 (65 - 75).

(l) Change F COARSE of OP6.
  (i) By means of OPERATOR SELECT, select OP6.
  (ii) Push switch No. 18.
  (iii) By means of DATA ENTRY, raise F COARSE of OP6 to 14.00.

(m) Set the OUTPUT LEVEL for OP6.
  (i) Push switch No. 27.
  (ii) While listening to the sound by means of DATA ENTRY raise the OUTPUT LEVEL of OP6. (l) and (m) are the SETTINGS to make the striking sounds for Electric Piano. The SETTING of the OUTPUT LEVEL for OP6 is especially important. A high metallic tone will be heard at the range of 20 to 30. If it is raised too much, it will not work so well.

(n) Turn ON OP's 1, 2 and 3, and balance everything (Fig.3/27).

Fig.3/27



ALG3 111111 OP6
OUTPUT LEVEL·····

Fig.3/28

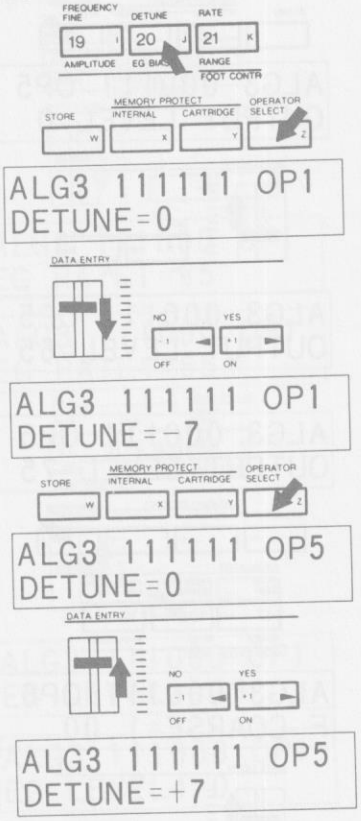
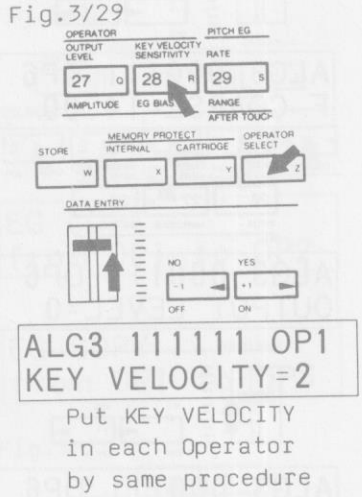


Fig.3/29



Put KEY VELOCITY in each Operator by same procedure

Success in this endeavour depends on the skilful SETTING of the OUTPUT LEVEL of each operator. Try to adjust them as sensitively as possible.

(o) Apply DETUNE (Fig.3/28).
- (i) Push switch No. 20.
- (ii) By means of OPERATOR SELECT, select OP1.
- (iii) By means of DATA ENTRY, set the DETUNE of OP1 to -7.
- (iv) By means of OPERATOR SELECT, select OP5.
- (v) By means of DATA ENTRY, set the DETUNE of OP5 to +7.

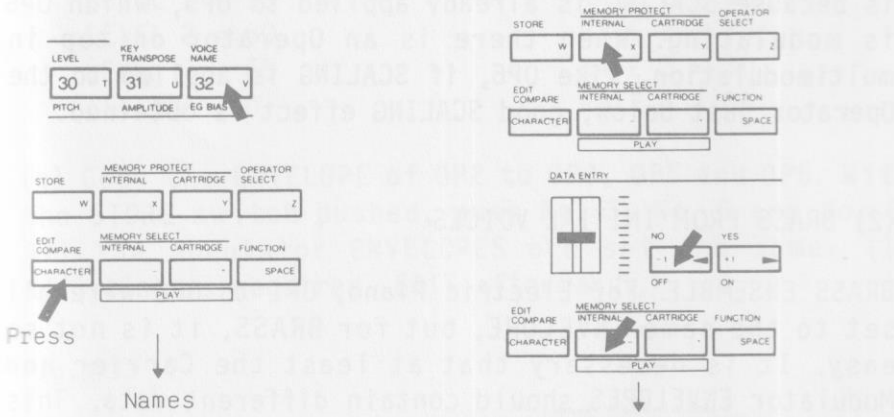
This produces a soft choral effect.

(p) Set the KEY VELOCITY SENSITIVITY for each operator (Fig.3/29).
- (i) Push switch No. 28.
- (ii) By means of OPERATOR SELECT, select OP1.
- (iii) By means of DATA ENTRY, set the KEY VELOCITY of OP1 to 2.
- (iv) Select operators by means of OPERATOR SELECT, set the KEY VELOCITY for OP's 2 to 5 EACH AT 2.
- (v) Set the KEY VELOCITY of OP6 at 6.

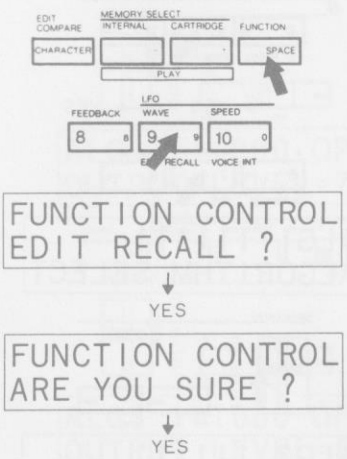
Except for OP6, the KEY VELOCITY of which is set at 6 in order to produce the 'striking' sounds, the KEY VELOCITY of each operator is set at 2, but of course they may be changed according to preference.
If no change appears when a key is struck. it is because the OUTPUT LEVEL for the Modulator is too low, so raise the OUTPUT LEVEL, making sure that the tone colour is not affected.

(q) Name each sound to be saved and store it in an appropriate bank (Fig.3/30).
- (i) Push No. 32.
- (ii) With the CHARACTER switch pushed, put in names.
- (iii) Push INTERNAL switch of MEMORY PROTECT, and by means of DATA ENTRY, release MEMORY PROTECT.
- (iv) Push INTERNAL switch of MEMORY SELECT.
- (v) With the STORE switch pushed,push the MEMORY BANK switch of the BANK which is to be used to store names. (If you fail in putting in names, push the FUNCTION switch marked by →. Push switch No. 9, marked by →. By means of DATA ENTRY, answer 'YES' twice. In this way, EDIT DATA returns.)

Fig.3/30



• In case of failure



All the operations needed to produce sounds from INITIAL VOICE and store them are completed. Were the exact sounds achieved? If not, look into the following points again;

- Is the Algorithm → now 3 ?
- Are the EG RATE and EG LEVEL, →, changed correctly with regard to PITCH EG? Is EG copy finished?
- Is the OUTPUT LEVEL, →, too high?
- Is the KEY VELOCITY, → , too fast?

If the higher tones of the keyboard sound unpleasant LEVEL SCALING is required.

(r) SCALINGS of OP2, OP3 and OP5 (Fig.3/31).

(i) Change the sound entered to EDIT MODE (if it has not been entered, it may be left).
(ii) Push switch No. 23.
(iii) By means of OPERATOR SELECT, indicate OP2.
(iv) Using DATA ENTRY, set OP2 BREAKPOINT to E3.
(v) Push switch No. 24.
(vi) Make sure R KEY SCALE is -LIN (in INITIAL DATA the SCALING curves are all -LIN)
(vii) Push switch No. 25.
(viii) Set R SCALE DEPTH to 10.
(ix) Set SCALING for OP3 and OP5 the same way.

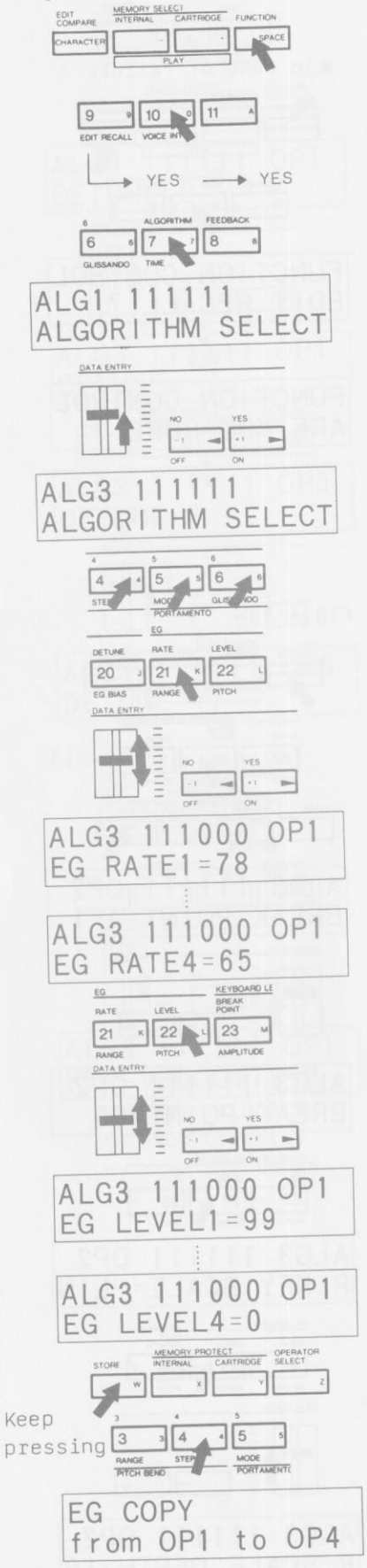
. Each SCALING DATA is as follows:

OP3 ... BREAK POINT = E3
R KEY SCALE = -LIN
R SCALE DEPTH = 14

OP5 ... BREAK POINT = E3
R KEY SCALE = -LIN
R SCALE DEPTH = 10

Fig.3/31

Fig.3/32



This produces a flat tone colour for the whole range of the Keyboard. The reason SCALING is not applied to OP6 is because SCALING is already applied to OP5, which OP6 is modulating. When there is an Operator on top in multimodulation, like OP6, if SCALING is applied to the Operator just below, good SCALING effect is obtained.

(2) BRASS FROM INITIAL VOICES

BRASS ENSEMBLE. For Electric Piano, OP1 to OP6 were all set to the same ENVELOPE, but for BRASS, it is not so easy. It is necessary that at least the Carrier and Modulator ENVELOPES should contain different data. This is necessary in order to give the beginning of the tone colour the character of BRASS.

The operating procedure is the same as in the former case, but the explanation has been simplified so be careful not to become confused. (For instance, such an indication as "By means of OPERATOR SELECT, indicate operator...." is omitted from now on).

(a) Execute VOICE INITIALIZE (Fig.3/32). Change to FUNCTION MODE, push No. 10 and answer 'YES' twice.

(b) Push No. 7 and by means of DATA ENTRY, choose Algorithm 3.

(c) Set OP' 4 to 6 OFF.

(d) Decide the ENVELOPE for OP1.

(i) Push No. 21 and by means of DATA ENTRY, set Rate 1 to 4.

(ii) Push No. 22 and by means of DATA ENTRY, set LEVEL 1 to 4.

The ENVELOPE DATA for OP1 is as follows:
(Make sure they are almost straight)

LEVEL 1 = 99	RATE 1 = 78
LEVEL 2 = 95	RATE 2 = 35
LEVEL 3 = 80	RATE 3 = 25
LEVEL 4 = 0	RATE 4 = 65

(e) Copy the ENVELOPE of OP1 to OP4. With the STORE switch depressed push Switch No. 4. The ENVELOPES of the Carriers OP1 and OP4 are the same. They are almost straight, and there is little level difference in their ENVELOPES.

(f) Decide the ENVELOPE for OP2 (Fig.3/33).

(i) By means of DATA ENTRY, set LEVEL 1 to 4.

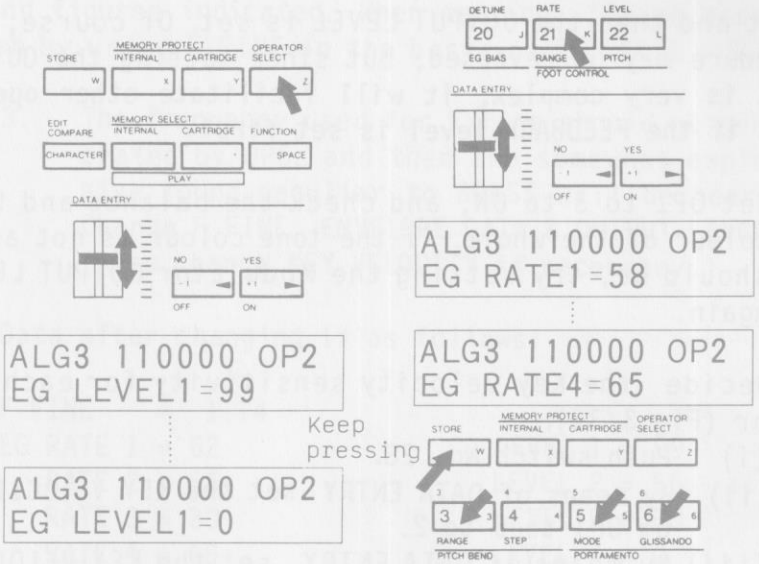
(ii) Push No. 21 and by means of DATA ENTRY, set Rate 1 to 4.

The ENVELOPE DATA for OP2 is as follows:

LEVEL 1 = 99	RATE 1 = 58
LEVEL 2 = 80	RATE 2 = 30
LEVEL 3 = 65	RATE 3 = 30
LEVEL 4 = 0	RATE 4 = 65

(g) Copy the ENVELOPE of OP2 to OP3, OP5 and OP6. With the STORE switch pushed, push No. 3, No. 5 and No. 6. All the Modulator ENVELOPES are set the same. (If adjusting is required, EDIT afterwards.)

Fig.3/33



(h) Set the OUTPUT LEVELS for OP2 and OP3 (Fig.3/34).
  (i) Push switch No. 27.
  (ii) While listening to the resulting sound, raise the OUTPUT LEVEL of OP2 (about 75 to 85) by means of DATA ENTRY.
  (iii) While listening to the resulting sound, raise the OUTPUT LEVEL of OP3 (about 65 to 75) by means of DATA ENTRY.
  A fairly clear BRASS sound should now be heard.

To make the latter half of the tone.
(i) EXCHANGE OPERATORS (Fig.3/35).
  (i) Set OP1 to 3 to OFF.
  (ii) Set OP 4 to 6 ON.
(j) By means of DATA ENTRY, set the OUTPUT LEVEL of OP4 to 99.
(k) While listening to the resulting sound, raise the OUTPUT LEVEL of OP5 (about 80 to 85) by means of DATA ENTRY.

Fig.3/34

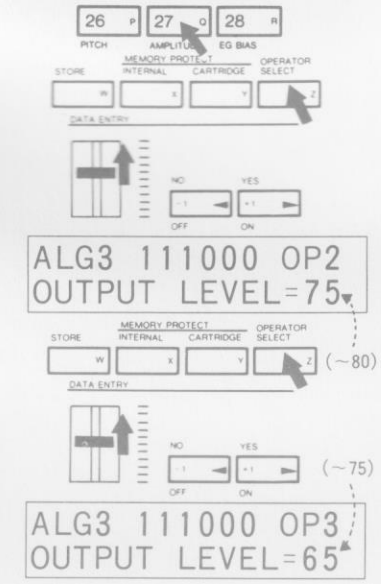
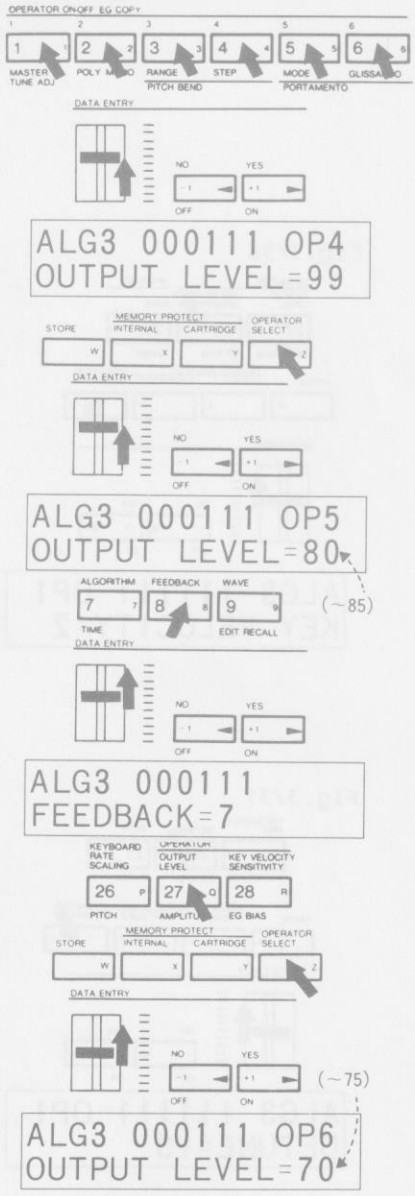


Fig.3/35



(l) Decide FEEDBACK LEVEL>
  (i) Push switch No. 8.
  (ii) By means of DATA ENTRY, set FEEDBACK to 7.

(m) Decide the OUTPUT LEVEL for OP6.
  (i) Push switch No. 27
  (ii) While listening to the resulting sound, raise the OUTPUT LEVEL of OP6 (about 70 to 75) by means of DATA ENTRY.

In this Algorithm (3) FEEDBACK is applied to OP6. Because of that, tone colour loses its smoothness, but gains brightness.

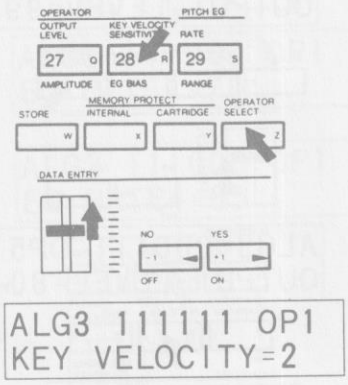
As for the setting procedure for the operator to which FEEDBACK is applied, the FEEDBACK level is fixed first and then the OUTPUT LEVEL is set. Of course, the procedure may be reversed, but since setting the OUTPUT LEVEL is very complex, it will facilitate other operations if the FEEDBACK level is set first.

(n) Set OP1 to 3 to ON, and check the balance and tone colour of the whole. If the tone colour is not as it should be, try setting the Modulator OUTPUT LEVEL again.

(o) Decide the Key velocity sensitivity for each operator (Fig.3/36).
  (i) Push switch No. 28.
  (ii) By means of DATA ENTRY set the KEY VELOCITIES of OP1 to 5 to 2.
  (iii) By means of DATA ENTRY, set the KEY VELOCITY of OP6 to 3.

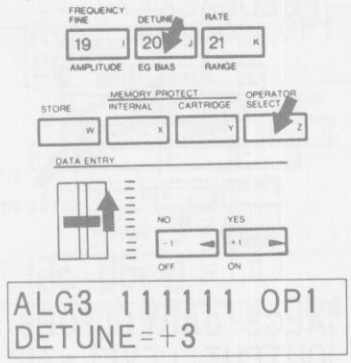
If Touch Sense is not required in the BRASS sound this operation should be omitted. As for SENSITIVITY, it may be set according to preference. If it is too strong however, playing is difficult.

Fig.3/36



(p) Apply DETUNE to each operator (Fig.3/37).
  (i) Push switch No. 20.
  (ii) By means of DATA ENTRY, set the DETUNE of OP1 to +3 and that of OP5 to -3. It should not be set too strongly. If it is too strong, the impact becomes weak.

Fig.3/37



(q) Name the tone and store it in a MEMORY BANK. This has created a typical BRASS SOUND. On the basis of this sound, EDIT as follows:

* 1. Move OP3 --> 2 --> 1 and OP6 --> 5 --> 4 by one octave.....Set F COARSE of OP1, OP2 and OP3 to 0.50.

* 2. Move OP3--> 2 --> 1 and OP6 --> 5 --> 4 by 5 degrees. F FINE of OP1 to OP3 must be set at 0.75 or 1.5.

Precautions to take when using F FINE.

When the frequency of the fine adjustment is made by F Fine based on F COARSE = 0.50, the frequency will increase by 1/100 each time the +1 DATA ENTRY switch is pressed. The frequency is incremented on the indicator in units of 1/100 from 0.50, e.g. 0.50 3/100 will be indicated as 0.50. Similarly, 0.515 will be indicated as 0.51. This means that 0.50 may show on the indicator as a set frequency of either 0.50 or 0.505. To check this, it is necessary to re-press the +1 switch. If, when this switch is pressed, the indicator does not move up one digit, then the frequency is as indicated. If it does move up, then the frequency is between the first and second figures indicated. When setting, fix an accurate pitch by using F FINE on the basis of F COARSE = 0.50.

* 3. The frequency used for F Fine should be generated by OP6, and then the somewhat explosive sound peculiar to BRASS will be heard. Change F FINE, ENVELOPE DATA & OUTPUT LEVEL. (Also change KEY VELOCITY if necessary.)

Data after changing is as follows:

F FINE = 1.14

EG RATE 1 =	62	LEVEL 1 =	99
RATE 2 =	56	LEVEL 2 =	55
RATE 3 =	30	LEVEL 3 =	50
RATE 4 =	65	LEVEL 4 =	0

OUTPUT LEVEL = 67

KEY VELOCITY = 5

(3) STRING SOUNDS FROM INITIAL VOICE

BRASS is a combination of Carrier, with an almost straight line ENVELOPE, and a Modulator which has a clear ATTACK and DECAY ENVELOPE.

The sound quality depends upon the Modulator setting, but in the case of strings, it is reversed. It is the Carrier setting that is important here. Keeping this in mind, proceed as follows: (The operating procedure has been simplified in that DATA ENTRY has been omitted.)

(a) Execute VOICE INITIALIZE.
(b) Push switch No. 7 and choose Algorithm No. 19.
(c) Set OP4 to 6 OFF.
(d) Decide the ENVELOPE for OP1.
  (i) Push switch No. 21 and set RATE 1 to 4.
  (ii) Push switch No. 22 and set LEVEL 1 to 4.

The ENVELOPE DATA for OP1 is as follows:

RATE 1 = 50	LEVEL 1 = 99
RATE 2 = 99	LEVEL 2 = 99
RATE 3 = 99	LEVEL 3 = 99
RATE 4 = 47	LEVEL 4 = 0

(e) Copy the ENVELOPE of OP1 in OP4 and OP5.
(f) Decide the ENVELOPE for OP2.
The ENVELOPE of OP2 is as follows:

RATE 1 = 90	LEVEL 1 = 99
RATE 2 = 99	LEVEL 2 = 99
RATE 3 = 99	LEVEL 3 = 99
RATE 4 = 40	LEVEL 4 = 0

(g) Copy the ENVELOPE of OP2 in OP3 and OP6.
(h) Push switch No. 28 and set the OUTPUT LEVEL for OP2 (about 60 to 65).
(i) Set the OUTPUT LEVEL for OP3 (about 80 to 85).
(j) Set OP1 to 3 to OFF and set OP4 to 6 to ON.
(k) Set the OUTPUT LEVEL of OP4 to 99 and set the OUTPUT LEVEL of OP5 to 85. Both may be set to 99, but it is better to set them both lower, because it is not desirable for the volume to be too high.
(l) Push switch No. 8 and set FEEDBACK to 7.
(m) Push switch No. 27 and set the OUTPUT LEVEL for OP6 (about 70 - 75).
(n) Set all the operators to ON.
(o) Push switch No. 20, and apply DETUNE to each OPERATOR

OP1 ------ DETUNE = + 7
OP2 ------ DETUNE = + 2
OP4 ------ DETUNE = - 2
OP6 ------ DETUNE = - 7

(p) Push switch No. 9 and set LFO WAVE to SINE.
(q) Push switch No. 10 and set LFO SPEED to 35 to 40.
(r) Push switch No. 11 and set LFO DELAY to 30 to 40.
(s) Push switch No. 12 and set LFO PM DEPTH to 5 to 10.
(t) Push switch No. 23, No. 24 and No. 25 one after another, and execute LEVEL SCALING for each operator.

OP1 ------ Scaling is not necessary.
OP2 ------ BREAK POINT = C3
OP3 ------ L KEY SCALE = + LIN
L SCALE DEPTH = 12
OP4 ------ Scaling is not necessary.
OP5 ------ -do-
OP6 ------ BREAK POINT = G3
L KEY SCALE = + LIN R KEY SCALE = - LIN
L SCALE DEPTH = 2 R SCALE DEPTH = 10

For the time being, set LEVEL SCALING by using the DATA mentioned above, and check it in relation to each operator's OUTPUT LEVEL; adjust as required.

(u) Pushing switch No. 32, name the tone, and store it it in a proper MEMORY BANK.

To set a string ensemble of fairly bright tone colour, the ENVELOPE is very simple, so the sound created depends on the OUTPUT LEVEL setting. In such a case, even a difference of one unit in setting will make a noticeable difference in the tone colour. Therefore the relationship with scaling becomes important. Adjust carefully.

When creating string sounds, setting RATE 1 of the Carrier smaller than that of the Modulator, is common. If this is reversed, and the RATE 1 of the Carrier is larger than that of the Modulator, the tone colour changes to something like BRASS because tone volume starts earlier than tone colour. (This is demonstrated if the RATE 1's of the Modulator OP2, OP3 and OP6 are slowed down to about 30).

As for RATE 4, it is just as explained in "Actual EDIT Example". The other data of ENVELOPE can be that of INITIAL DATA.

(4) ORGAN FROM INITIAL VOICE

The DX has a range of ORGAN tones in the ROM, but most are 'elegant' tones. For ORGAN we want to use an ALGORITHM producing an almost bare sine wave, such as ALG 32 or ALG 31, but this type of ALGORITHM lacks power. To make a powerful organ, an ALGORITHM such as ALG 5 is preferable.

First make the BASIC ORGAN tone from the combination of OP2 → OP1 and OP4 → OP3, and a KEY CLICK tone from the combination of OP6 → OP5. Therefore, it is only OP6 that requires ENVELOPE SETTING, and the ENVELOPE (straight line) of INITIAL DATA may be used as it is.

Try SETTING without looking at the explanation below, because it is essential to familiarize oneself with the operation of the DX.

(a) Execute VOICE INITIALIZE.
(b) Select ALG 5.
(c) Set OP3 to 6 to OFF.
(d) Set the OUTPUT LEVEL for OP2 (about 80 to 85).
(e) Set F COARSE of OP1 and OP2 to 0.50.
(f) Set OP1 and OP2 to off and OP3 and OP4 to ON.
(g) Set the OUTPUT LEVEL of OP3 to 99.
(h) Set the OUTPUT LEVEL for OP4 (about 80 to 85).
(i) Set OP3 and OP4 to OFF and set OP5 and OP6 to ON.

(j) Set the OUTPUT LEVEL of OP5 to 99.
(k) Set the EG of OP6 as follows:

RATE 1 = 99	LEVEL 1 = 99
RATE 2 = 70	LEVEL 2 = 80
RATE 3 = 99	LEVEL 3 = 80
RATE 4 = 99	LEVEL 4 = 0

(l) Set the OUTPUT LEVEL for OP6 (about 85 to 90).
(m) Set F COARSE's of OP5 and OP6 to 0.50.
(n) Set all the operators to ON.
(o) Apply DETUNE to the following operators:

OP1	DETUNE = +7
OP4	DETUNE = -7
OP6	DETUNE = +7

(p) Select each data of LFO.
WAVE = SINE, SPEED = 35, DELAY PMD = 4 to 8.
(q) Make sure that PM SENS is 3.
(r) Execute LEVEL SCALING to the following operators:

OP2	BREAK POINT	= D3
	L KEY SCALE	= + LIN
	R KEY SCALE	= - LIN
	L SCALE DEPTH	= 30
	R SCALE DEPTH	= 6
OP4	BREAK POINT	= D3
	L KEY SCALE	= + LIN
	R KEY SCALE	= - LIN
	L SCALE DEPTH	= 17
	R SCALE DEPTH	= 20
OP6	BREAK POINT	= D3
	R KEY SCALE	= - LIN
	R SCALE DEPTH	= 30

(s) Name, and store in a proper MEMORY BANK. As for SCALING, try a fine adjustment.

Fig.3/38

DATE/PRESET No. : /

VOICE NAME : Organ ALG29

PROGRAMMER : Yasuhito Fukuda

ALGORITHM	FEEDBACK	LFO WAVE	LFO SPEED	LFO DELAY	LFO PMD	LFO AMD	LFO SYNC	MOD. SENSITIVITY PITCH	MOD. SENSITIVITY AMPLITUDE
29	0	TRIANGLE	35	0	0	0	ON	3	

OP		OSCILLATOR MODE/SYNC	OSCILLATOR FREQ. COARSE	OSCILLATOR FREQ. FINE	OSCILLATOR DETUNE	EG RATE 1	EG RATE 2	EG RATE 3	EG RATE 4	EG LEVEL 1	EG LEVEL 2	EG LEVEL 3	EG LEVEL 4	KEYBOARD LEVEL SCALING BREAK POINT	KEYBOARD LEVEL SCALING CURVE L	KEYBOARD LEVEL SCALING CURVE R	KEYBOARD LEVEL SCALING DEPTH L	KEYBOARD LEVEL SCALING DEPTH R	KEYBOARD RATE SCALING	OPERATOR OUTPUT LEVEL	OPERATOR VELOCITY SENS.	OP AMPLITUDE
6	Ratio	ON	1.00	1.00	0	99	99	99	99	99	99	99	0	D3	+L	-L	19	30	0	84	0	0
5	Ratio		1.00	1.00	+7	99	99	99	99	99	99	99	0	A-1	-L	-L	0	0	0	99	0	0
4	Ratio		1.00	1.00	-7	99	74	99	99	99	95	95	0	C3	+L	-L	15	20	0	83	0	0
3	Ratio		1.00	1.00	0	99	99	99	99	99	99	99	0	A-1	-L	-L	0	0	0	99	0	0
2	Ratio		0.75	0.75	0	99	99	99	99	99	99	99	0	F3	-L	-L	0	16	0	99	0	0
1	Ratio		0.50	0.50	0	99	99	99	99	99	99	99	0	A-1	-L	-L	0	0	0	99	0	0

PITCH EG RATE 1	PITCH EG RATE 2	PITCH EG RATE 3	PITCH EG RATE 4	PITCH EG LEVEL 1	PITCH EG LEVEL 2	PITCH EG LEVEL 3	PITCH EG LEVEL 4	KEY TRANSPOSE	VOICE NAME
50	50	50	50	50	50	50	50	C3	

Here is the DATA for ORGAN using ALG29 (Fig.3/38).

(5) COWBELL FROM INITIAL VOICE

Try a metallic sound with F FINE used on the Modulator. The ratio of M to C is most important but it must be set by ear. As for the data, since there may be better values; try various ways. Using ALG5, make the basic COWBELL tone colour by the combination of OP2 → OP1 and OP4 → OP3 as for the organ and increase the harmonic content by using OP6 → OP5. Make a muted ENVELOPE in which the key is played STACCATO.

(a) Execute VOICE INITIALIZE.
(b) Select ALG5 and set OPs 3 to 6 to OFF.
(c) Set the EG of OP1 as follows:

RATE 1 = 95 to 99	LEVEL 1 = 99
RATE 2 = 67	LEVEL 2 = 0
RATE 3 = 99	LEVEL 3 = 0
RATE 4 = 55	LEVEL 4 = 0

(d) Copy the ENVELOPE of OP1 in all the other operators (make a fine adjustment afterwards).
(e) Set the OUTPUT LEVEL for OP2 (90 to 95 is good).
(f) Set F FINE of OP2 to 2.84 (increase on the base F COARSE = 2.00).
(g) Set OP1 and OP2 to OFF and set OP3 and OP4 to ON.
(h) Set the OUTPUT LEVEL of OP3 to 99.
(i) Set the OUTPUT LEVEL for OP4 (90 to 95).
(j) Set F FINE of OP4 to 2.84.
(k) Set OP3 and OP4 to OFF and set OP5 and OP6 to ON.
(l) Set the OUTPUT LEVEL of OP5 to 99.
(m) Set the OUTPUT LEVEL for OP6 (90 to 95).
(n) Set F FINE of OP6 to 4.24.
(o) Set all the operators and make a fine adjustment.

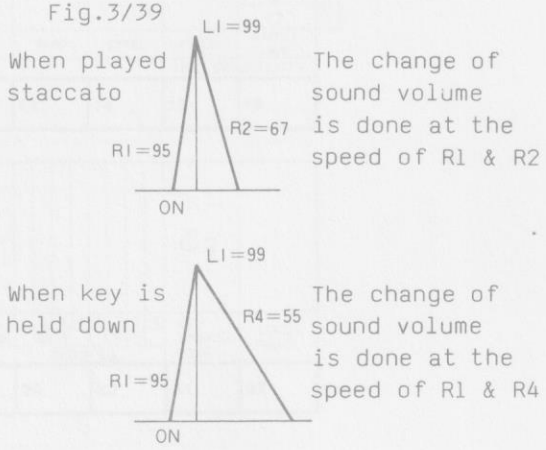
Example:

OP2	RATE 1 = 99	RATE 2 = 65	RATE 4 = 45
OP4	RATE 1 = 99	RATE 2 = 60	RATE 4 = 45
OP5	RATE 1 = 99	RATE 2 = 65	RATE 4 = 50
OP6	RATE 1 = 99	RATE 2 = 60	RATE 4 = 45

(p) Set OP1 through 5 to KEY VELOCITY = 2 and set OP6 to KEY VELOCITY = 3.
(q) Name, and store in an appropriate MEMORY BANK.

In the mid range of the keyboard the tones sound like a COWBELL. The reason why tones are muted when the keys are pushed and released when played staccato is because of the ENVELOPE as shown in Fig.3/39. Since this is used frequently it is worth noting.

Fig.3/39



(6) SYNTHESIZER DRUM FROM INITIAL VOICE

To make sounds without using FM MODULATION or PITCH EG but using SYNCHRONIZATION of LFO, provide the SETTING that makes the PITCH drop as soon as the key is played. Pay attention to LFO SPEED and the RATE 4 of the EG, but the others are very simple.

(a) Execute VOICE INITIALIZE.
(b) Choose ALG32.
(c) Set the EG of OP1 as follows:

RATE 1 = 99	LEVEL 1 = 99
RATE 2 = 99	LEVEL 2 = 99
RATE 3 = 99	LEVEL 3 = 99
RATE 4 = 50	LEVEL 4 = 0

(d) Copy the ENVELOPE of OP1 in all the other OPERATORS.
(e) Set all the OUTPUT LEVELS for OP2 through 6 to 99.
(f) Set each DATA of LFO.
WAVE = SINE SPEED = 2 PMD = 99 SYNC = ON
(g) Set PM SENS to 7.
(h) Name, and store in an appropriate MEMORY BANK.

This is all. It is important to square the RATE 4 VELOCITY of the ENVELOPE with the interval velocity which is going down by LFO PITCH MODULATION. Of course if the key is kept ON the pitch goes up and down.

It is good to change LFO SPEED, RATE 4 or LFO WAVE. If the wave is SAW UP, an effect where PITCH goes up as soon as the key is played and with S/HOLD, different pitches may be obtained every time a key is played.

4. VARIOUS KINDS OF SOUNDS

Having got used to handling the DX, create some original sounds and store them in a MEMORY BANK. Here is some data that can be used to produce some interesting sounds on the DX.

Referring to the following lists programme and edit the sounds preferred.

In this data list, any PARAMETER having no direct relation with the sounds is omitted.

The omitted sections of the data are basically the same as INITIAL DATA.

(1) KAWAII NE (Cute)

An FM SOUND SOURCE SYNTHESIZER is unbeatable at making this type of sound. It is so easy that it can be produced at the first attempt at the DX's keyboard. The Algorithm is No. 5 which produces a sound that is an admixture of sounds produced by two OPERATORS. Even though the F COARSE and F FINE of OP4 (at 13.08) is

high, the F COARSE of OP3 (at 2.00) is high, and the OUTPUT LEVEL of OP4 is low. The combination of OP6 → OP5 produces a soft continuous sound, which makes the whole tone colour calm and steady (Fig.3/40).

Fig.3/40

DATE/PRESET No. : /

VOICE NAME : Kawaii ne

PROGRAMMER : Yasuhiko Fukuda

ALGO-RITHM	FEED-BACK	LFO WAVE	LFO SPEED	LFO DELAY	LFO PMD	LFO AMD	LFO SYNC	MOD. SENSITIVITY PITCH	MOD. SENSITIVITY AMPLI-TUDE	OP
5	0	SINE	33	60	10	0	ON	3	0	6
									0	5
									0	4
									0	3
									0	2
									0	1

OP		MODE/SYNC	FREQ. COARSE	FREQ. FINE	DETUNE	EG RATE 1 2 3 4	EG LEVEL 1 2 3 4	BREAK POINT	KEYBOARD LEVEL SCALING CURVE L R	KEYBOARD LEVEL SCALING DEPTH L R	K.BOARD RATE SCALING	OPERATOR OUTPUT LEVEL	OPERATOR VELOCITY SENS.	PITCH EG RATE 1 2 3 4	PITCH EG LEVEL 1 2 3 4	KEY TRANSPOSE	VOICE NAME
6	R	ON	1.00			99 99 99 45	99 99 99 0					63	0			C3	
5	R		1.00			60 20 99 45	99 30 30 0					99	0				
4	R		12.00	13.08		99 35 99 45	99 50 50 0					35	4				
3	R		2.00			99 35 14 45	99 50 10 0					99	2				
2	R		1.00			99 35 99 45	99 50 50 0					70	3				
1	R		1.00			99 50 99 45	99 20 20 0					99	2				

(2) GLASS VOICE

This sound is like that created when the rim of a wine glass is rubbed lightly with a moistened finger. Creating this sound is very easy. Algorithm No. 5 is used - all the operators produce the same tone colour and are mixed. Since the F COARSE of the Carrier at 4.00 is very high, the resultant tone may be unpleasant. The OUTPUT LEVEL of the Modulator and the LEVEL SCALING of each OPERATOR are very important elements in determining the tone colour. Be careful not to turn up the volume during the performance (Fig.3/41).

Fig.3/41

DATE/PRESET No. : /

VOICE NAME : Glass Voice

PROGRAMMER : Yasuhiko Fukuda

ALGO-RITHM	FEED-BACK	LFO WAVE	LFO SPEED	LFO DELAY	LFO PMD	LFO AMD	LFO SYNC	MOD. SENSITIVITY PITCH	MOD. SENSITIVITY AMPLI-TUDE	OP
5	4	TRIANGLE	45	64	4	0	OFF	4	0	6
									0	5
									0	4
									0	3
									0	2
									0	1

OP		MODE/SYNC	FREQ. COARSE	FREQ. FINE	DETUNE	EG RATE 1 2 3 4	EG LEVEL 1 2 3 4	BREAK POINT	KEYBOARD LEVEL SCALING CURVE L R	KEYBOARD LEVEL SCALING DEPTH L R	K.BOARD RATE SCALING	OPERATOR OUTPUT LEVEL	OPERATOR VELOCITY SENS.	PITCH EG RATE 1 2 3 4	PITCH EG LEVEL 1 2 3 4	KEY TRANSPOSE	VOICE NAME
6	R	OFF	8.00		+4	18 16 49 37	99 35 0 0	B3	+L -L	22 50	0	68	0			C3	
5	R		4.00		-5	30 31 49 37	99 35 0 0	B3	+L +L	22 22	0	87	0				
4	R		8.00		0	34 31 49 37	99 35 0 0	B3	+L -L	50 22	0	68	0				
3	R		4.00		+2	34 31 49 37	99 35 0 0	B3	+L +L	22 13	0	99	0				
2	R		8.00		+4	27 21 49 37	99 35 0 0	B3	+L -L	22 31	0	65	0				
1	R		4.00		-4	25 30 28 45	99 95 98 0	F2	-L +L	0 9	0	99	0				

(3) 3-SPLIT

The range of the keyboard has been divided into thirds and a different tone colour is assigned to each segment, low, middle and high. Algorithm No. 5 has been used with LEVEL SCALING of the Carrier.

It is very important to set different BREAK POINTS for each tone colour. The SCALING of the Modulator is basically executed by the same curve as the Carrier. Only OP6 is -LIN, quite opposite to Carrier OP5, R KEY SCALE = +LIN. This prevents the sound quality in the higher range from being flat. (Fig.3/42).

Fig.3/42

DATE/PRESET No. : /

VOICE NAME : 3 - split

PROGRAMMER : Yasuhiko Fukuda

ALGO-RITHM	FEED-BACK	LFO WAVE	LFO SPEED	LFO DELAY	LFO PMD	LFO AMD	LFO SYNC	LFO PITCH MOD. SENSITIVITY	LFO AMPLITUDE MOD. SENSITIVITY
5	3	TRIANGLE	35	0	0	0	ON	5	OP6: 0
									OP5: 0
									OP4: 0
									OP3: 0
									OP2: 0
									OP1: 0

OP	OSCILLATOR MODE/SYNC	FREQ. COARSE	FREQ. FINE	DETUNE	EG RATE 1 2 3 4	EG LEVEL 1 2 3 4	KEYBOARD LEVEL SCALING BREAK POINT	CURVE L	CURVE R	DEPTH L	DEPTH R	K.BOARD RATE SCALING	OPERATOR OUTPUT LEVEL	OPERATOR VELOCITY SENS.	PITCH EG RATE 1 2 3 4	PITCH EG LEVEL 1 2 3 4	KEY TRANSPOSE	VOICE NAME
6	R	1.00		0	44 35 20 30 99 98 17 0		C5	-L	-L	99	30	0	85	3			C3	
5	R	1.00		0	80 30 20 65 99 80 65 0		F4	-L	+L	99	99	0	75	0				
4	R	19.00		0	99 21 20 36 88 89 0 0		G3	-L	-L	94	99	0	99	7				
3	R	4.00		0	99 53 20 32 99 7 0 0		G3	-L	-L	94	99	0	99	2				
2	R	1.00		0	67 31 20 35 99 18 0 0		D2	+L	-L	99	99	4	90	2				
1	R	1.00		0	99 53 20 88 99 95 0 0		C2	+L	-L	99	99	4	99	1				

OSCILLATOR: MODE/SYNC = OFF

(4) SYNTH LEAD

This creates the sound of a guitar according to the way it is played. As the F COARSE 17.00 of OP6 brightens the tone colour, care must be taken when setting OUTPUT and LEVEL SCALING. The sound is quite loud in solo and is hard on the ears (Fig.3/43).

Fig.3/43

DATE/PRESET No. : /

VOICE NAME : Synth Lead

PROGRAMMER : Yasuhiko Fukuda

ALGO-RITHM	FEED-BACK	LFO WAVE	LFO SPEED	LFO DELAY	LFO PMD	LFO AMD	LFO SYNC	LFO PITCH MOD. SENSITIVITY	LFO AMPLITUDE MOD. SENSITIVITY
18	7	SINE	37	42	0	99	OFF	4	OP6: 0
									OP5: 0
									OP4: 0
									OP3: 0
									OP2: 0
									OP1: 0

OP	OSCILLATOR MODE/SYNC	FREQ. COARSE	FREQ. FINE	DETUNE	EG RATE 1 2 3 4	EG LEVEL 1 2 3 4	KEYBOARD LEVEL SCALING BREAK POINT	CURVE L	CURVE R	DEPTH L	DEPTH R	K.BOARD RATE SCALING	OPERATOR OUTPUT LEVEL	OPERATOR VELOCITY SENS.	PITCH EG RATE 1 2 3 4	PITCH EG LEVEL 1 2 3 4	KEY TRANSPOSE	VOICE NAME
6	R	17.00		0	99 70 60 0 99 99 97 0		F2		-L	21		3	46	0			C3	
5	R	1.00		-2	80 21 41 0 99 66 81 0					0		1	80	0				
4	R	1.00		+2	75 14 28 60 99 90 0 0		A3		-L	60		6	82	0				
3	R	1.00		0	99 87 0 0 99 90 96 0		F2		-L	11		3	82	0				
2	R	1.00		-1	99 95 0 0 99 96 94 0					0		3	85	0				
1	R	1.00		+2	99 48 41 70 99 95 98 0					0		1	95	2				

OSCILLATOR: MODE/SYNC = OFF

(5) 5TH SYNTH 1

(6) 5TH SYNTH 2

Both are fivefold SYNTHESIZER SOUNDS, the F COARSES of which have been shifted. Since they are detuned they sound similar to an organ. 5th SYNTH 1 has a strong clicking sound (Fig.3/44, Fig.3/45).

Fig.3/44

DATE/PRESET No. : /

VOICE NAME : 5th Synth 1

PROGRAMMER : Yasuhiko Fukuda

ALGO-RITHM	FEED-BACK	LFO WAVE	LFO SPEED	LFO DELAY	LFO PMD	LFO AMD	LFO SYNC	MOD. SENSITIVITY PITCH	MOD. SENSITIVITY AMPLI-TUDE	OP
4	5	SINE	35	89	0	0	ON	3	0	6
									0	5
									0	4
									0	3
									0	2
									0	1

OP		OSCILLATOR MODE/SYNC	FREQ. COARSE	FREQ. FINE	DETUNE	EG RATE 1 2 3 4	EG LEVEL 1 2 3 4	KEYBOARD LEVEL SCALING BREAK POINT	KEYBOARD LEVEL SCALING CURVE L R	KEYBOARD LEVEL SCALING DEPTH L R	K.BOARD RATE SCALING	OPERATOR OUTPUT LEVEL	OPERATOR VELOC-ITY SENS.	PITCH EG RATE 1 2 3 4	PITCH EG LEVEL 1 2 3 4	KEY TRANS-POSE	VOICE NAME
6	R	OFF	0.50	0.75		99 64 99 71	99 85 85 0	G3	-L	9	0	70	2			C3	
5	R		0.50	0.75	+3	99 10 99 71	99 80 80 0	G3	+L	10	0	82	1				
4	R		0.50	0.75		99 99 99 71	99 99 99 0				0	95	2				
3	R		1.00			95 25 23 71	99 85 90 0	G3	+L -L	20 30	0	78	1				
2	R		1.00			85 30 30 71	99 85 80 0	G3	-L	30	0	82	2				
1	R		1.00		-3	97 99 99 71	99 99 99 0				0	99	1				

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

Fig.3/45

DATE/PRESET No. : /

VOICE NAME : 5th Synth 2

PROGRAMMER : Yasuhiko Fukuda

ALGO-RITHM	FEED-BACK	LFO WAVE	LFO SPEED	LFO DELAY	LFO PMD	LFO AMD	LFO SYNC	MOD. SENSITIVITY PITCH	MOD. SENSITIVITY AMPLI-TUDE	OP
5	4	SINE	35	89	6	0	OFF	3	0	6
									0	5
									0	4
									0	3
									0	2
									0	1

OP		OSCILLATOR MODE/SYNC	FREQ. COARSE	FREQ. FINE	DETUNE	EG RATE 1 2 3 4	EG LEVEL 1 2 3 4	KEYBOARD LEVEL SCALING BREAK POINT	KEYBOARD LEVEL SCALING CURVE L R	KEYBOARD LEVEL SCALING DEPTH L R	K.BOARD RATE SCALING	OPERATOR OUTPUT LEVEL	OPERATOR VELOC-ITY SENS.	PITCH EG RATE 1 2 3 4	PITCH EG LEVEL 1 2 3 4	KEY TRANS-POSE	VOICE NAME
6	R	OFF	0.50	0.75	-6	99 65 99 99	99 91 91 0	E3	+L -L	17 20	0	99	2			C3	
5	R		0.50	0.75	0	99 65 99 99	99 91 91 0	E3	+L -L	99 0	0	99	2				
4	R		0.50		+6	99 65 99 99	99 92 93 0	C3	+L -L	19 6	0	99	2				
3	R		0.50		0	99 63 99 99	99 95 95 0	A-1	-L -L	0 0	0	90	1				
2	R		1.00		0	99 68 99 99	99 91 91 0	C3	+L -L	17 10	0	96	0				
1	R		1.00		-6	99 68 99 99	99 91 91 0	A-1	-1 -L	99 0	0	99	1				

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

(7) GORI GORI (Hurdy Gurdy)

This is a strong sound with a great deal of KEY VELOCITY effect. Algorithm No. 18 is used and the OUTPUT LEVEL of each operator is high (Fig.3/46).

Fig.3/46

DATE/PRESET No. : /

VOICE NAME : Gori gori

PROGRAMMER : Yasuhito Fukuda

ALGORITHM	FEEDBACK	WAVE	SPEED	DELAY	PMD	AMD	SYNC	PITCH	AMPLITUDE
18	5	TRIANGLE	30	0	0	0	OFF	4	0
									0
									0
									0
									0
									0

LFO — MOD. SENSITIVITY

OP	MODE/SYNC	FREQ. COARSE	FREQ. FINE	DETUNE	RATE (1 2 3 4)	LEVEL (1 2 3 4)	BREAK POINT	CURVE L	CURVE R	DEPTH L	DEPTH R	K.BOARD RATE SCALING	OUTPUT LEVEL	VELOCITY SENS.	RATE (1 2 3 4)	LEVEL (1 2 3 4)	KEY TRANSPOSE	VOICE NAME
6	R	0.50		+1	92 18 51 36	99 43 0 0	A2	-L	-L	0	99	3	74	1			C2	
5	R	0.50		0	90 24 25 31	99 0 0 0	C2	+E	-L	0	26	3	94	1				
4	R	1.00		-1	97 21 10 25	99 86 48 0	A-1	-L	-L	0	0	3	84	1				
3	R	5.00		+1	90 18 20 50	99 85 0 0	F2	-L	-L	0	27	5	84	1				
2	R	1.00		+2	95 0 25 0	99 67 0 0	A-1	-L	-L	0	10	2	90	1				
1	R	1.00		0	80 19 10 50	99 62 0 0	A-1	-L	-L	0	0	3	99	2				

OSCILLATOR — EG — KEYBOARD LEVEL SCALING — OPERATOR — PITCH EG

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

(8) BAKUHATSU (Explosion)

This is an explosive sound made by setting the OUTPUT LEVEL of each operator at its highest. The ENVELOPE is set to sound explosive whether it is played legato or staccato. Since it is impossible to change the frequency components of a noise like this it is somewhat unrealistic (Fig.3/47).

Fig.3/47

DATE/PRESET No. : /

VOICE NAME : Bakuhatsu

PROGRAMMER : Yasuhito Fukuda

ALGORITHM	FEEDBACK	WAVE	SPEED	DELAY	PMD	AMD	SYNC	PITCH	AMPLITUDE
17	7								

LFO — MOD. SENSITIVITY

OP	MODE/SYNC	FREQ. COARSE	FREQ. FINE	DETUNE	RATE (1 2 3 4)	LEVEL (1 2 3 4)	BREAK POINT	CURVE L	CURVE R	DEPTH L	DEPTH R	K.BOARD RATE SCALING	OUTPUT LEVEL	VELOCITY SENS.	RATE (1 2 3 4)	LEVEL (1 2 3 4)	KEY TRANSPOSE	VOICE NAME
6	R	0.50			99 43 20 17	99 95 27 0							99	0			C3	
5	R	0.50	0.59		99 43 20 18	99 95 27 0							99	0				
4	R	0.50			99 43 20 18	99 95 27 0							99	2				
3	R	0.50			99 43 20 18	99 95 27 0							99	0				
2	R	0.50			99 43 20 15	99 95 27 0							99	0				
1	R	0.50			99 43 20 27	99 90 27 0							99	0				

OSCILLATOR — EG — KEYBOARD LEVEL SCALING — OPERATOR — PITCH EG

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32

(9) AKI NO YORU 1 (Autumn Night 1)

(10) AKI NO YORU 2 (Autumn Night 2)

This is a simulated chirping of insects in the field in the autumn. Autumn Night 1 has SAMPLE and HOLD WAVE which applies AMPLITUDE MODULATION to each operator

(Fig.3/48). In Autumn Night 2 since the LFO wave is saw-tooth it sounds more intermittent. Both use the FIXED MODE (Fig.3/49).

Fig.3/48

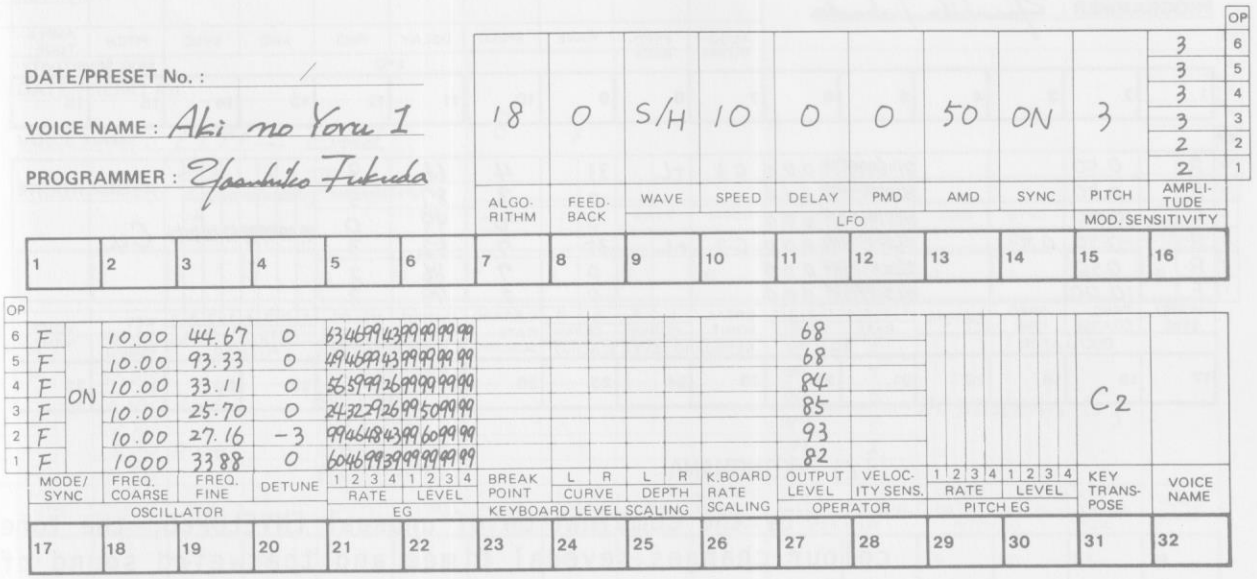
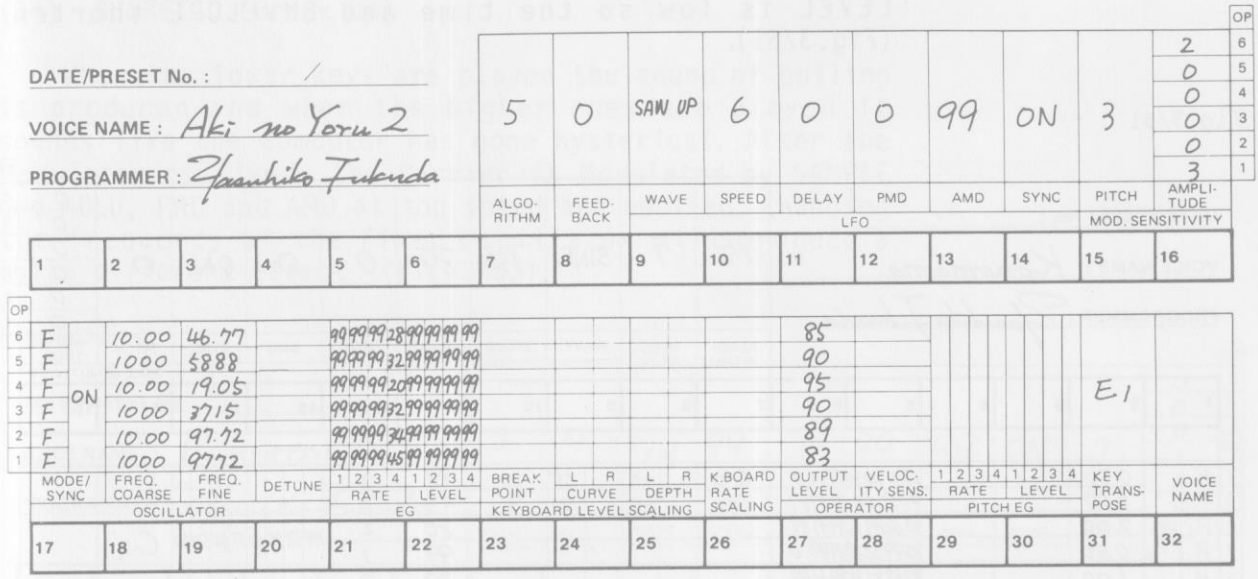


Fig.3/49



(11) DOGS

This barking sound uses the fixed mode for the Carrier. The ENVELOPE is made up so that the PITCH changes by PITCH EG the moment the key is played and the changes in tone colour and volume cease the moment the change ends. A strong ATTACK produces a strong bark and a soft ATTACK a muffled sound by making the KEY VELOCITY effective (Fig.3/50).

Fig.3/50

DATE/PRESET No. : /

VOICE NAME : Dogs

PROGRAMMER : Yasuhito Fukuda

ALGO-RITHM	FEED-BACK	LFO WAVE	LFO SPEED	LFO DELAY	LFO PMD	LFO AMD	LFO SYNC	MOD. SENSITIVITY PITCH	MOD. SENSITIVITY AMPLITUDE
3	0								

OP		OSCILLATOR MODE/SYNC	OSCILLATOR FREQ. COARSE	OSCILLATOR FREQ. FINE	OSCILLATOR DETUNE	EG RATE 1 2 3 4	EG LEVEL 1 2 3 4	KEYBOARD LEVEL SCALING BREAK POINT	KEYBOARD LEVEL SCALING L CURVE	KEYBOARD LEVEL SCALING R CURVE	KEYBOARD LEVEL SCALING L DEPTH	KEYBOARD LEVEL SCALING R DEPTH	K.BOARD RATE SCALING	OPERATOR OUTPUT LEVEL	OPERATOR VELOCITY SENS.	PITCH EG RATE 1 2 3 4	PITCH EG LEVEL 1 2 3 4	KEY TRANSPOSE	VOICE NAME
6	R	ON	0.50			81 16 99 99	99 00 00 00	C3	+L		33		4	66	3	99 99 99 99	67 50 50 50	C4	
5	R		0.50			64 45 99 99	99 00 00 00				0		3	87	5				
4	F		10.00			64 51 99 99	99 00 00 00				0		0	99	0				
3	R		0.50	0.93		69 79 99 99	99 00 00 00	C3	+L		35		7	52	3				
2	R		0.50			72 20 99 99	99 00 00 00				0		7	86	2				
1	F		10.00			64 54 99 99	99 00 00 00				0		2	99	2				

(12) KONOMAMA

By the combination of unusual ENVELOPES, the tone colour changes several times and the weird sound of KONOMAMAAAR is produced. This sound becomes quicker upon a light touch and slower with a heavy touch.

As mentioned before, because the EG RATE of the DX is decided in relation to LEVEL, when a touch is soft, LEVEL is low so the time and ENVELOPE shorten (Fig.3/51).

Fig.3/51

DATE/PRESET No. : /

VOICE NAME : Konomama

PROGRAMMER : Yasuhito Fukuda

ALGO-RITHM	FEED-BACK	LFO WAVE	LFO SPEED	LFO DELAY	LFO PMD	LFO AMD	LFO SYNC	MOD. SENSITIVITY PITCH	MOD. SENSITIVITY AMPLITUDE
15	7	SINE	35	89	0	0	ON	0	

OP		OSCILLATOR MODE/SYNC	OSCILLATOR FREQ. COARSE	OSCILLATOR FREQ. FINE	OSCILLATOR DETUNE	EG RATE 1 2 3 4	EG LEVEL 1 2 3 4	KEYBOARD LEVEL SCALING BREAK POINT	KEYBOARD LEVEL SCALING L CURVE	KEYBOARD LEVEL SCALING R CURVE	KEYBOARD LEVEL SCALING L DEPTH	KEYBOARD LEVEL SCALING R DEPTH	K.BOARD RATE SCALING	OPERATOR OUTPUT LEVEL	OPERATOR VELOCITY SENS.	PITCH EG RATE 1 2 3 4	PITCH EG LEVEL 1 2 3 4	KEY TRANSPOSE	VOICE NAME
6	R	OFF	0.50			68 71 20 30 99	33 00	G0		-E		55	2	99	2	99 98 95	60 37 50 50	C3	
5	R		0.50			99 A2 04 09 97	87 00	G0		-E		50	3	93	2				
4	R		2.00			74 49 99 36 99	39 99							80	2				
3	R		0.50			82 99 20 89 99	99 00							99	1				
2	R		1.00			82 58 82 35 99	63 99							82	2				
1	R		1.00			68 88 20 46 99	99 99							99	1				

(13) 1999 ... END

This is an example of PITCH used 'dashingly'. Since the RATE 1 of the Carrier is much faster than that of the Modulator, a bare sine wave sound is produced when a

key is played; if the key is held down the PITCH suddenly falls. A surprise effect can be obtained by using staccato first and suddenly applying PITCH ENVELOPE by keeping the key pressed. A better effect is produced by playing a chord (Fig.3/52).

Fig.3/52

DATE/PRESET No. : /

VOICE NAME : 1999... End

PROGRAMMER : Yasuhiko Fukuda

OP	ALGO-RITHM	FEED-BACK	WAVE	SPEED	DELAY	PMD	AMD	SYNC	PITCH	AMPLI-TUDE
			LFO						MOD. SENSITIVITY	
6	8	7								
5										
4										
3										
2										
1										

OP	MODE/SYNC	FREQ. COARSE	FREQ. FINE	DETUNE	EG RATE 1 2 3 4	EG LEVEL 1 2 3 4	BREAK POINT	KEYBOARD LEVEL SCALING L CURVE	KEYBOARD LEVEL SCALING R CURVE	KEYBOARD LEVEL SCALING L DEPTH	KEYBOARD LEVEL SCALING R DEPTH	K.BOARD RATE SCALING	OUTPUT LEVEL	VELOCITY SENS.	PITCH EG RATE 1 2 3 4	PITCH EG LEVEL 1 2 3 4	KEY TRANSPOSE	VOICE NAME
	OSCILLATOR				EG		KEYBOARD LEVEL SCALING						OPERATOR		PITCH EG			
6	R	0.50			14 99 20 30 99 99 0 0								99	2				
5	R	0.50			19 79 20 40 99 97 87 0								99	2				
4	R	2.00	2.22		34 99 20 27 99 33 0 0								99	2				
3	R	0.50			36 53 20 53 99 99 0 0								99	1				
2	R	3.00	3.06		22 99 42 35 99 32 89 0								99	2				
1	R	0.50			99 53 85 99 99 99 85 0								99	1				
	OFF														29 99 92 53 56 95 45 83		C3	
	17	18	19	20	21	22	23	24		25		26	27	28	29	30	31	32

(14) BUNRETSU (Break Up)

When the lower keys are played the sound of boiling is produced and when the higher ones are played it sounds like the computer has gone hysterical. After the Modulator is fixed, the Carrier is Modulated by SAMPLE and HOLD, PMD and AMD at top speed are applied. Changing the frequency of the fixed oscillator will produce a quite different effect (Fig.3/53).

Fig.3/53

DATE/PRESET No. : /

VOICE NAME : Bunretsu

PROGRAMMER : Yasuhiko Fukuda.

OP	ALGO-RITHM	FEED-BACK	WAVE	SPEED	DELAY	PMD	AMD	SYNC	PITCH	AMPLI-TUDE
			LFO						MOD. SENSITIVITY	
6	3	4	S/H	99	0	99	99	ON	7	0
5										0
4										0
3										3
2										0
1										0

OP	MODE/SYNC	FREQ. COARSE	FREQ. FINE	DETUNE	EG RATE 1 2 3 4	EG LEVEL 1 2 3 4	BREAK POINT	KEYBOARD LEVEL SCALING L CURVE	KEYBOARD LEVEL SCALING R CURVE	KEYBOARD LEVEL SCALING L DEPTH	KEYBOARD LEVEL SCALING R DEPTH	K.BOARD RATE SCALING	OUTPUT LEVEL	VELOCITY SENS.	PITCH EG RATE 1 2 3 4	PITCH EG LEVEL 1 2 3 4	KEY TRANSPOSE	VOICE NAME
	OSCILLATOR				EG		KEYBOARD LEVEL SCALING						OPERATOR		PITCH EG			
6	F	1.000	4.677		99 99 99 40 99 99 99 0		C3		-L	99			99					
5	R	0.50			99 99 99 39 99 99 99 0								77					
4	R	0.50	0.58		99 99 99 46 99 99 99 0								99					
3	R	0.50	0.99		99 99 99 39 99 99 99 0		C3		-L	99			57				C3	
2	F	10.00	12.59		99 99 99 79 99 99 99 0		G3		-L	20			99					
1	R	1.00	1.50		99 99 99 40 99 99 99 0								99					
	ON																	
	17	18	19	20	21	22	23	24		25		26	27	28	29	30	31	32

APPENDIX

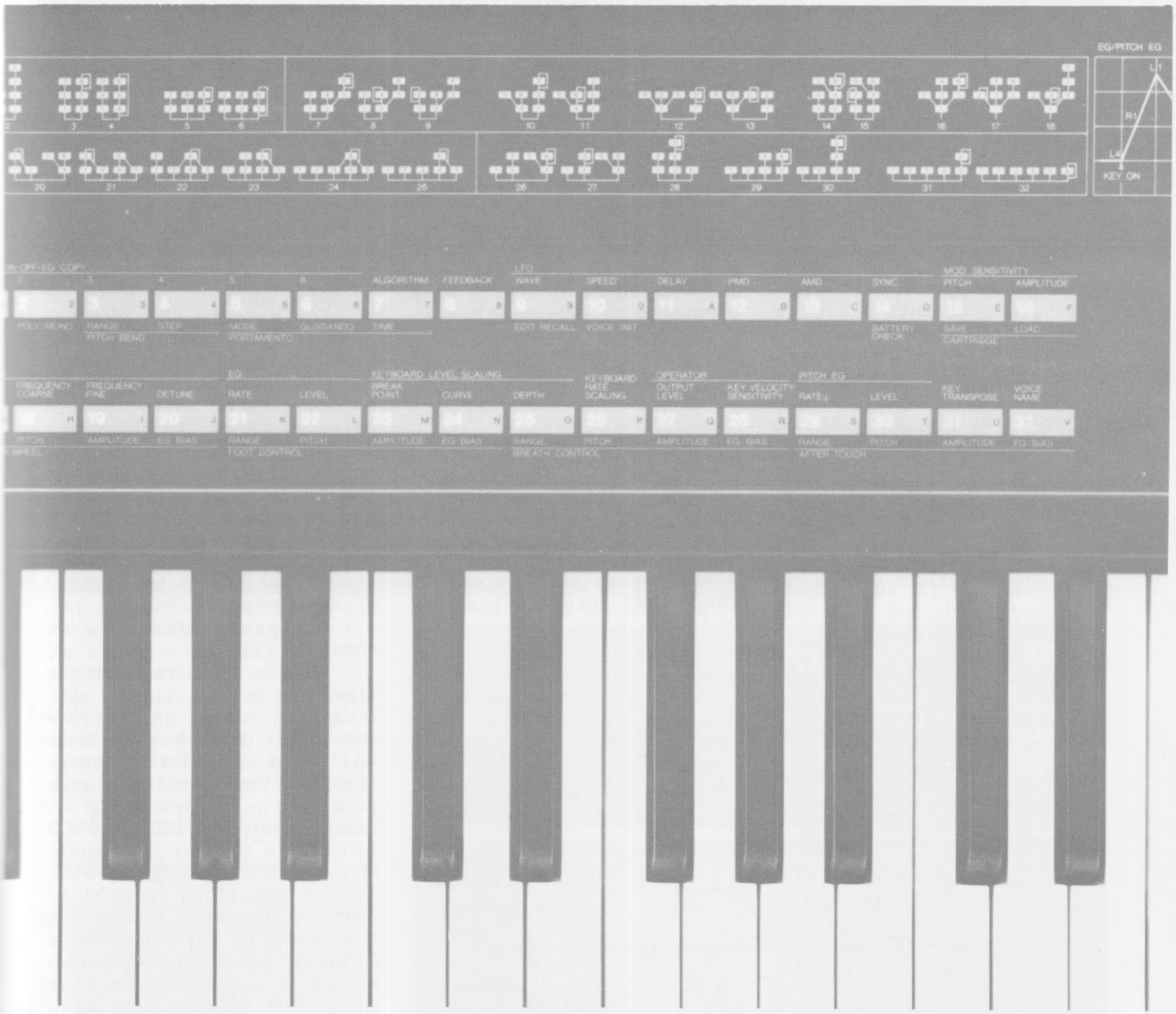
INFORMATION CONCERNING DX HARDWARE

SOLUTION FOR MIS-SETTING

PRACTICAL TECHNIQUE FOR REMOTE KEYBOARD KX 1

ADVANCED METHODS FOR USE OF DX WITH MIDI TERMINAL

INTERNAL VOICE DATA LIST



APPENDIX PART 1

INFORMATION CONCERNING DX HARDWARE

It will be very helpful to understand the theoretical mechanism of the DX when exploring the creation of original sounds by using the DX. In this part the hardware of DX is studied apart from its operation. Knowledge of the hardware will assist in understanding the knowledge gained from the section on practical technique and to conclude the theory of sound making.

SOUND SOURCE OF DX IS 'SINE WAVE MEMORY'

In order to appreciate the mechanism of the DX series it is essential to understand how the oscillators of DX1, 7 and 9 memorize waveforms.

In the case of an analog oscillator, electrical signals are sent into circuits and oscillators produce actual sawtooth and square waves, but in the case of the DX it is very simple.

Now that the price of ICs is very low there are many low cost keyboards which have ROM (Read Only Memory) drawn waveform as a sound source but the waveform memory which the DX has is of only one kind and memorizes only sine waves.

A sine wave is that simple sound made by a tuning fork or flute. This memory which makes the sound immediately after instruction is called Sine Wave Memory. This can produce waves of various frequencies when input data is changed.

For instance, a wave of 440 Hz may be produced in many ways as shown in Fig.1. In this figure of a sine wave generated by Sine Wave Memory, time is shown on the horizontal axis and the output on the vertical axis.

DX MEMORIZES SINE WAVES BY FUNCTION MEMORY

How does this Sine Wave Memory memorize sine waves? What constitutes an instruction to this memory? How is it possible to change frequency?

The sine wave as its name implies, is the sine of a trigonometric function. This means it takes the same shape as the sine graph. Therefore, if the Sine Wave Memory memorizes the function of sin θ and then values of θ are input, sin θs (i.e. answers) may be obtained.

For example if a teacher asks for the product of two multiplied by two, the pupil will answer 'Four' and 'Six' to the question of two multiplied by three. In this case the pupil who answers means the function memory memorized the function of $y = 2x$ (x is a natural number of $1 \leq x \leq 9$).

Sine Wave Memory has memorized all the answers of sin θ instead of the multiplication tables.

The graph of a sine is shown in Fig.2.

What is required for the time being is that $\sin\theta = \frac{y}{r}$ (r is the radius of a circle and is 1). Understanding this will make it easier to understand further functions such as $\sin 0° = \frac{0}{1} = 0$, $\sin 90° = \frac{1}{1} = 1$ (max), $\sin 180° = \frac{0}{1} = 0$ $\sin 270° = \frac{-1}{1} = -1$ (minimum), $\sin 360° = \sin 0 = \frac{0}{1} = 0$, etc.

Putting sin θ from 0° to 360° in Sine Wave Memory (in the case of θ1>360°, θ is θ-360°). Assume it took one second to put the values from 0° to 360° in Sine Wave Memory. As work time is constant

Fig.1

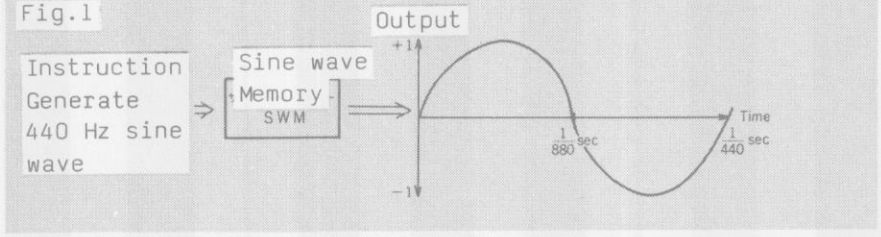


Fig.2

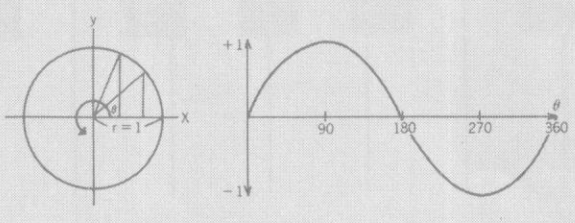
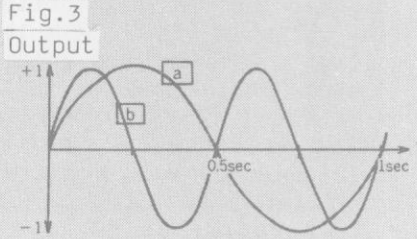
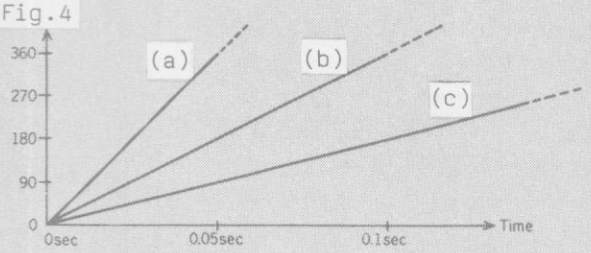


Fig.3



If θ takes one second to change from 0° to 360°, SWM generates a sine wave which = 1 cycle per sec. If it takes 0.5 seconds, SWM generates a sine wave which completes one cycle in 1/2 second. That is (b) in Fig.3

Fig.4



for every θ, one sin θ is generated respectively, a sine wave such as at A in Fig.3 is generated. That is to say a sine wave of 1 Hz.

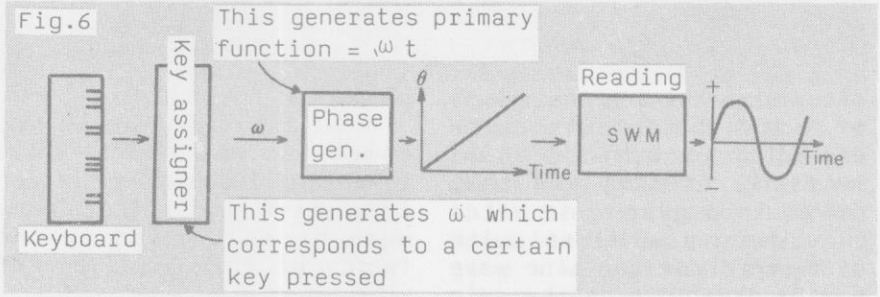
Thus if it takes 0.5 seconds to put in the values of θ from 0° to 360° (i.e. at double the speed of the former example), the generated sine wave is one of 2 Hz with a cycle completed in a half second. This is shown in Fig.3.

Accordingly the frequency of the sine wave generated by the Sine Wave Memory is to be decided by the speed of putting in θ; taking this θ as a primary function as to time t, it is possible to draw a graph such as Fig.4 by using the formula θ = ωt (ω is a constant).

In (a) θ reaches 360° in 0.05 seconds; in (b), θ reaches 360° in .1 seconds and in (c), θ reaches 360° in 0.2 seconds. Therefore sine waves (a), (b) and (c) with a frequency as in Fig. 5 are decided according to the state of input of each θ. It is the slope of the graph of θ =ωt, i.e. the constant ω, that decides the frequency of the sine wave generated by the sine wave memory.

The circuit shown in Fig.6 illustrates this. When a key is on, the key assigner which searches for which key is on, works to generate ω corresponding to the key like the CV of an analog synthesizer. It is possible to read

Fig.6



Sine Wave Memory as it makes a primary function θ= ωt

EXAMPLE 1

What is the function of the sine wave generated by Sine Wave Memory when ω is 4π?

When ω is 4π, θ is 4πt, and when t is 1 θ is 4π. This means θ changes up to 720° in a second. Since 720°/360° is 2 the answer is 2 Hz.

EXAMPLE 2

What is the value of the constant ω in the formula θ = ωt of phase generator, when Sine Wave Memory is generating a sine wave of 440 Hz?

This looks to be very complicated but what is required is what the input state of θ should be in order to generate a sine wave of one cycle in 1/440 second. For a sine wave to complete a cycle θ has to change from 0° to 360° so if θ is 2π (=360°) and t is 1/440, 2π is (ω) x 1/440 and then ω = 880 .

intervals may be read.

How else may different wave forms be read?

If we put θ in a straight line by way of θ = ω t, the sine wave memory generates only the sine wave of sin ωt. What will happen if it is put in a disturbed way such as (b) in Fig.7?

Normally θ would increase in a straight line with the lapse of time. But in this case it increases in a varying way, so when the sine wave memory is read, it may be recognised as a wave form which is of the same frequency but is different from the sine wave because the value of θ at a certain time t1 is not in accordance with (a) in its former state, except for t1 = 0 sec, t1 =0.5 sec, and t1 = 1 sec.

This is shown in Fig.8.

Fig.7

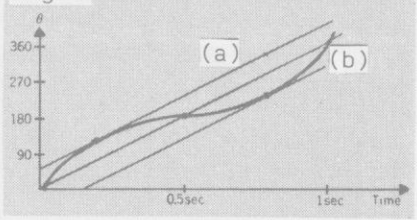
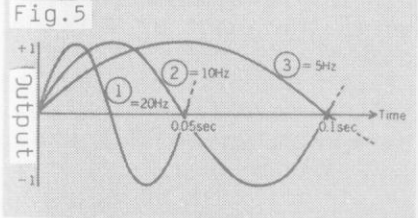


Fig.5



READING WAVEFORMS OTHER THAN SINE WAVES

Frequency is decided by the value of ω. Thus only the sine waves of different

Fig.8

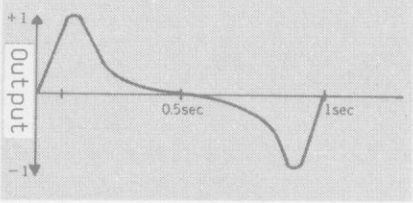
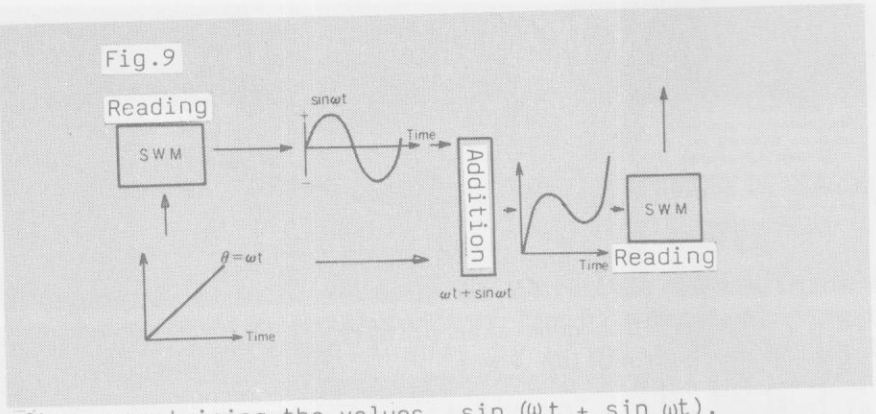


Fig.9



After ascertaining the values of θ and the outputs corresponding to θ in the graph in Fig.2, if they are then drawn in a graph one after the other, a waveform quite different from the sine wave may be drawn. It can be said that this is all of FM.

In short, this means that a reading of Sine Wave Memory is biased.

It could appear, in fact as in Fig.9.

Sin ωt, which was read from θ = ωt, is added to ωt (shown in Fig. 7) and becomes θ = ωt + sin ωt, and in this state it reads the other Sine Wave Memory so it becomes sin (ωt + sin ωt).

But this formula is not completed yet because there is an amplitude of vibration in a wave and the formula must be multiplied by the factor of this amplitude of vibration.

Suppose the sine wave of a certain frequency is now being generated from the Sine Wave Memory as shown in Fig.10. In this case, using only this method, the frequency of the sine wave generated may be changed, but the amplitude of vibration may not.

The reason is that even if the value of ω changes in any way, in the maximum and minimum values there is no change.

Add an Envelope Generator (EG), to follow the Sine Wave Memory in order to decide amplitudes of vibration as shown in Fig.11. It may be assumed that in this section, the value of sin ωt is multiplied by such factors as 2 or 3 etc. For instance 4 sin ωt multiplied by 4 by the EG is twice as large as 2 sin ωt multiplied by 2 in amplitude of vibration.

Fig.10

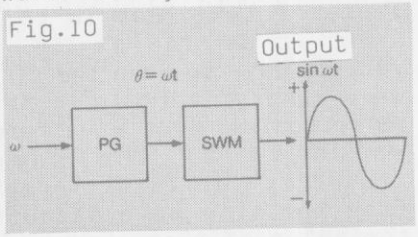


Fig.11

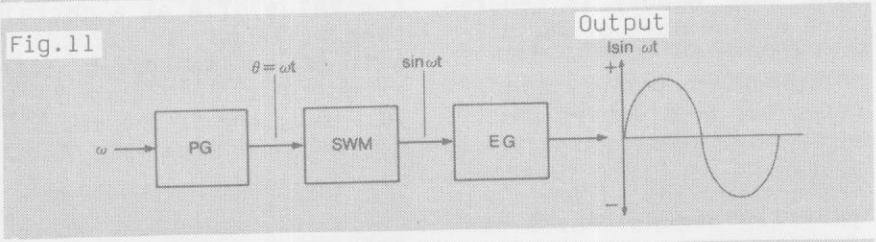
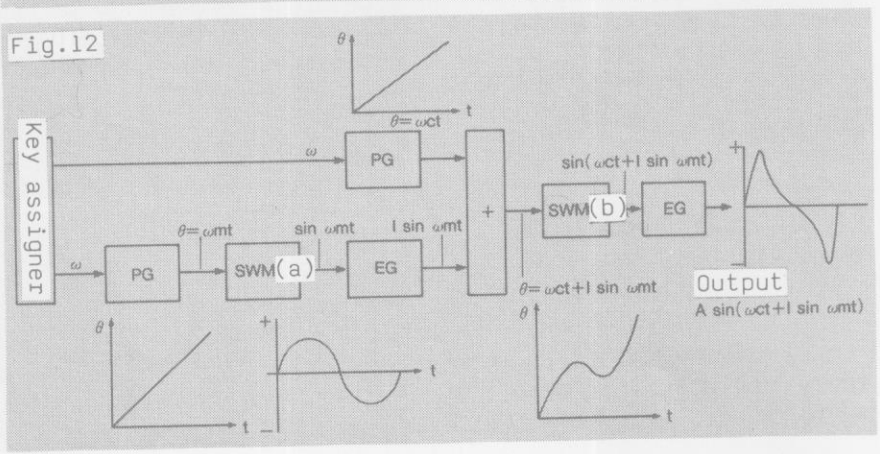


Fig.12



Of course as EG is the section controlling amplitude of vibration by time, the function which should multiply sin ωt must be the function of the time itself (e.g. I(t)sin ωt) but this becomes complicated. So EG may be seen as being the method of obtaining a certain amplitude of vibration.

It may be thought that EG in this case is making an envelope of a straight line of the so-called ORGAN type. In this way a complete method for making a sine wave of arbitrary frequency and amplitude has been completed and the output at this time is I sin ωt.

Output F which was taken out in this way becomes a sine wave with a certain pitch and volume if it is generated as an audio signal. But I sin ωt becomes 'Modulation data' in the reading of the Sine Wave Memory (b) when it is used as data to read another Sine Wave Memory (b) in bias, by adding to θ = ωt generated by PG(b) as shown in Fig.12.

In this case, the larger the factor I, the greater the difference of the state of input of θ is from its state of original linear increase.

Look at Fig.13(a) and Fig.14(a). Fig.13 is the graph of an increasing state, θ = ωt + I sin ωt in the case of I being small. The amplitude of vibration of I sin t is small as I is small, so the difference between the original increasing state, θ = ωt of θ and biased increasing state, θ = ωt + I sin ωt is small. In other words the input of θ is not biased so much. This is called 'Modulation' and the result read from Sine Wave Memory (b) by this is shown in Fig.13(b).

In the case of Fig.14(a),

Fig.13 (a)

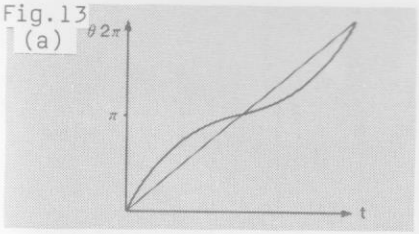


Fig.13 (b)

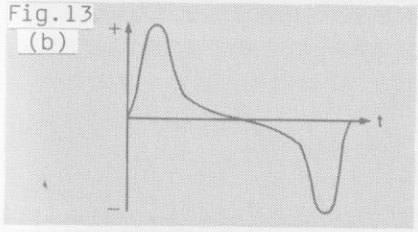


Fig.13 (c)

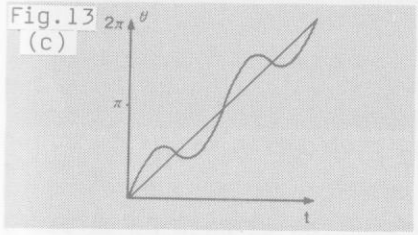


Fig.14 (a)

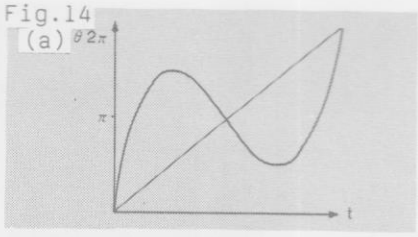


Fig.14 (c)

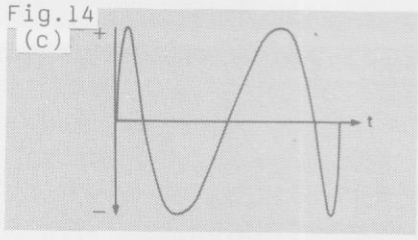
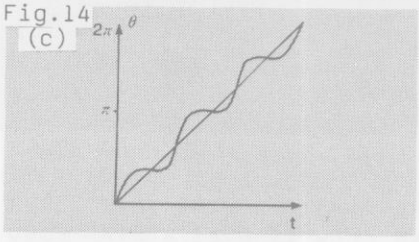


Fig.14 (c)



I is large as is the bias of input θ. Fig.14(b) shows the result read in the Sine Wave Memory (b) by this.

It may be seen that it has a violent waveform even without listening to it as the wave is wavering several times each cycle.

The output waveform of Sine Wave Memory (b) changes according to the value of I and as there is also EG which controls the amplitude of the output waveform, the output read by θ=ωt+I sinωt is shown by the following formula:

Output F =

A sin (ωct+I sin ωmt)

It can now be understood how important is the factor I of modulation data in deciding the size of bias in the input state of θ, for making sounds in the FM sound source. If the setting of I is wrong the waveform is very little different from the sine wave or else is extremely distorted. I corresponds to the output level of the modulator in the DX series.

Fig.15

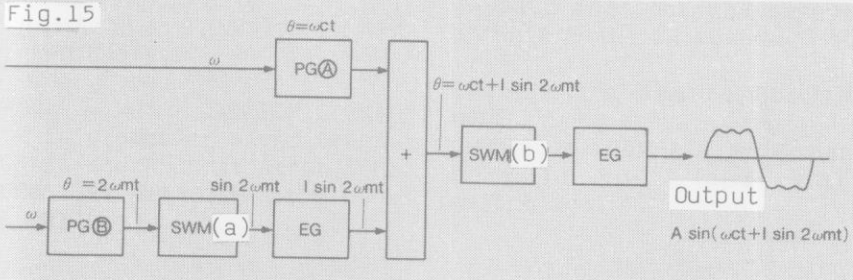


Fig.16

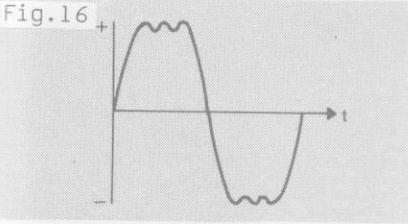
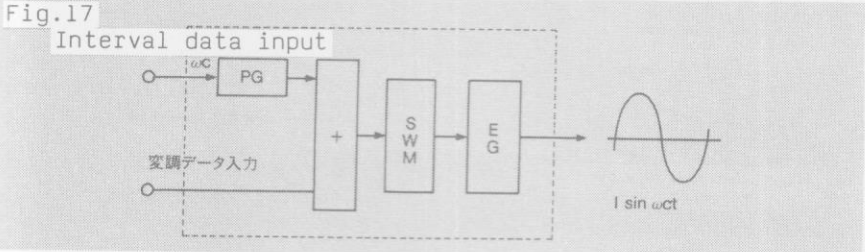


Fig.17



FREQUENCY CHANGES CHANGE OF MODULATION WAVEFORMS

In the preceding explanation the graph of θ=ωt+I sin ωt was always as shown in Fig.13(a) and Fig.14(a). In short, this means that the speed of putting in θ from 0° to 360° corresponds to the speed of a cycle of sine wave which biases the formula, but actually it is possible to give a vibration by way of sine wave two or three times while θ changes from 0° to 360°.

For instance, if you make PG(a) and PG(b) generate different primary functions such as θ = ωt and θ = 2ωt as shown in Fig.15, modulation dataI sin 2ωt has double the frequency of the musical interval data ωt at the time of the Sine Wave Memory (b) reading. Its added state is shown in Fig.13(c).

Accordingly, as the frequency of the modulation sine wave changes, the generated waveform changes steadily. If I is a proper value in θ = ωt + I sin 2ωt, the waveform of output F=A sin (ωt+I sin 2ωt) becomes similar to a square wave Fig.16.

Construction diagram 15 of the FM sound source is for explanation and in the DX series we call a set of PG, Sine Wave Memory and EG 'An Operator'. Fig.17 shows an operator working independently. As modulation data is not put in at this time, θ = ωt which generates PG, reads the Sine Wave Memory, and, multiplying by factor I in EG becomes the sine wave output I sinωt.

In this case this works in connection with another operator as shown in Fig.18. Output I sin ωt of OP2 is added to ωt generated by PG of OP1 and reads the Sine Wave Memory in OP1. This, multiplied by factor A gener-

ated in EG, is output F=A sin (ωct+Isinωmt) of OP1 and this is called a multiplex modulation because this output may be used as modulation data for DX. This is the state of more than three operators connected from end to end.

As shown in Fig.19 output F1 of OP2 is added to ωct generated by PG of OP1 at the entrance of OP1, and becomes ωct+A sin (ωct+I sin ωmt). Then it reads the Sine Wave Memory and passing through EG becomes output $F_2 = A_2 \sin [\omega ct + A_1 \sin (\omega ct + I \sin \omega mt)]$.

In a way this may be a simple formula but drawing the waveform of output F2 exactly would be very difficult.

Fig.18

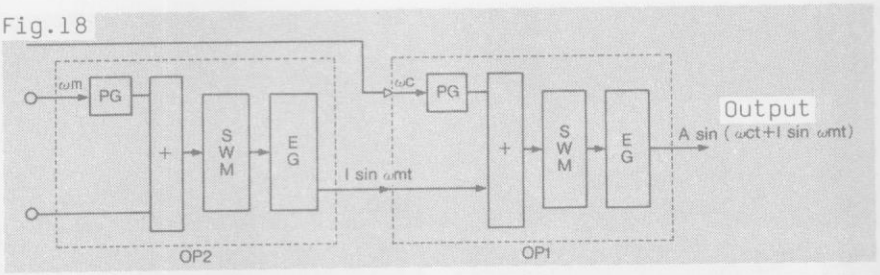
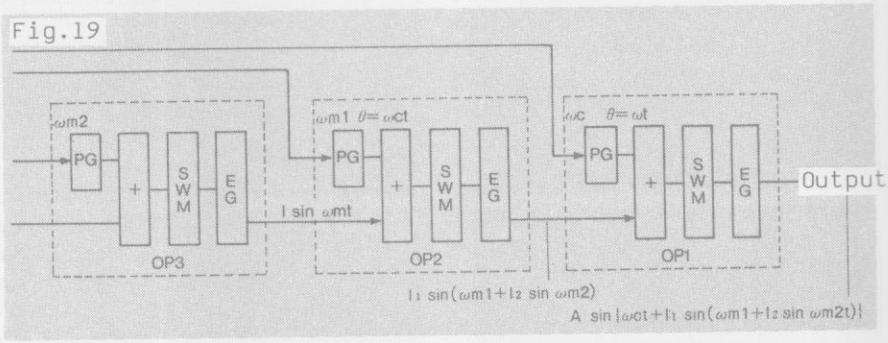


Fig.19



APPENDIX PART 2

SOLUTION TO MIS-SETTING

DX has many parameters to consider in order to develop sound. Therefore, mis-setting and difficulties may occur until operation of the system is fully understood.

Here are some difficulties which easily happen by setting mistakes, their causes and solutions explained.

1. Though power switch is on, amplifier is normal and volume is turned up, no sound heard or sound stops during editing.

CAUSE A. EG BIAS is on.
CURE: All the EG biases of function control mode have to be off.

CAUSE B. Output level of Carrier operator too low.
CURE: Correct the output level of the Carrier. Output level of Carrier should always be kept over 90.

CAUSE C. Mistake in setting CARRIER ENVELOPE.
CURE: Correct ENVELOPE DATA of the Carrier.

CAUSE D. When CARRIER OPERATOR is producing sound OPERATOR is stuck under about 50Hz.
CURE: Set OPERATOR MODE back to RATIO.

2. When you cannot drown out sound.

CAUSE A. EG RATE 4 of CARRIER OPERATOR is too low(RATE 4≦5).
CURE: Make RATE 4 higher. In case RATE 4 is 0 it will be out as a matter of course.

CAUSE B. EG LEVEL 4 of CARRIER OPERATOR is too high.
CURE: Turn LEVEL 4 to 0 and touch the keys 16 times. As the information of LEVEL 4>0 is cleared at the time of the 17th touch, it returns to LEVEL 4 = 0 and the sound is drowned out.

3. Data does not change even if DATA ENTRY is moved.

CAUSE. It's set to COMPARE MODE.
CURE: Set COMPARE MODE back to EDIT MODE (push EDIT switch again).

4. COMPARE MODE does not go back to EDIT MODE.

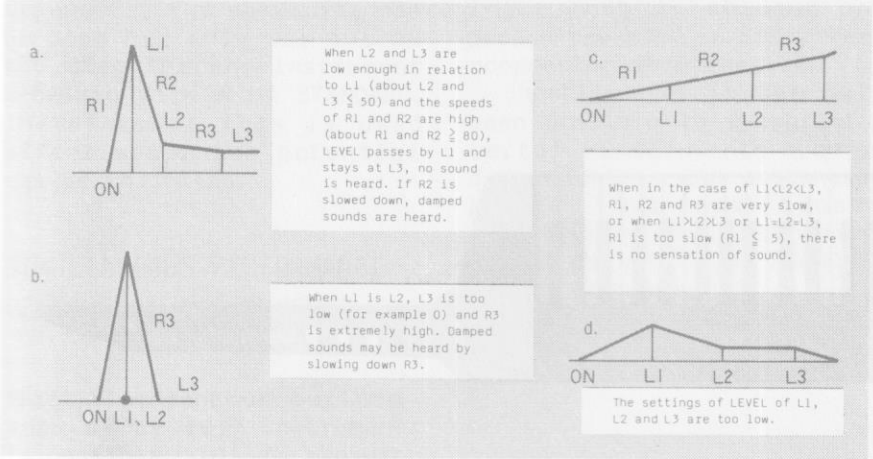
CAUSE. It has been put in COMPARE MODE after pushing the EDIT MODE switch No. 32. When writing the voice name, EDIT/COMPARE switch became CHARACTER BUTTON so it cannot switch from COMPARE MODE to EDIT MODE.
CURE: Push any switch among the 32 switches on the right hand side except No. 32 and push EDIT switch.

5. When POLY MODE changes place with MONO MODE unnoticed or it switches to PORTAMENTO.
CAUSE. PLAY MODE is set to select POLY/MONO and PORTA TIME by FUNCTION CONTROL MODE and DATA ENTRY has been moved.
CURE: Reduce FUNCTION CONTROL MODE to BATTERY CHECK of switch No. 14.

6. PITCH BEND RANGE does not move from 12.

CAUSE. It has become PITCH BEND STEP > 0.
CURE: Make PITCH BEND STEP =0 (refer to Chapter 2 'Function Control Mode').

7. SUSTAIN PEDAL does not work.
CAUSE. RATE 3 of EG of selected tone colour is too fast or LEVEL 3 is too low (SUSTAIN PEDAL of DX executes RATE 3 and keeps LEVEL 3).
CURE: RATE 3 of EG must be slowed down or LEVEL 3 must be moved up.



APPENDIX PART 3

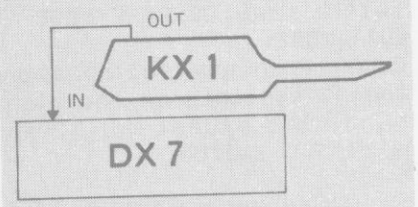
APPLICATION OF REMOTE KEYBOARD KX 1

The KX 1 is the keyboard that allows mobility on stage within a 15m radius by remotely controlling DX. Use of the KX 1 with DX-7.

WHEN KX 1 CONTROLS ONE DX-7

The KX 1 is a remote keyboard with TOUCH RESPONSE which controls DX by connecting with KX 1 but it has no sound source inside.

Fig.1

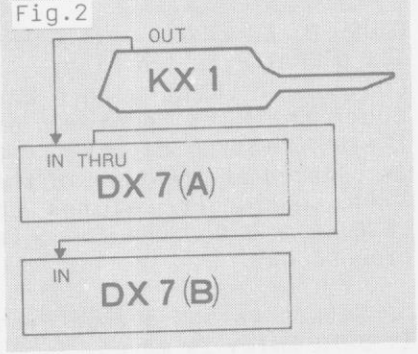


As KX controls DX it must be connected as shown above. If the number of notes to be played is under 16, it is possible to play the DX keyboard at the same time. Note that when PORTAMENTO TIME is in use by the KX 1, the PORTAMENTO TIME of FUNCTION CONTROL MODE of DX7 is also in use.

So, if MIDI cable is accidentally pulled out when the PORTAMENTO TIME is >0, the DX-7 stays in the PORTAMENTO state.

KX CONTROLLING TWO DX-7s

Fig.2

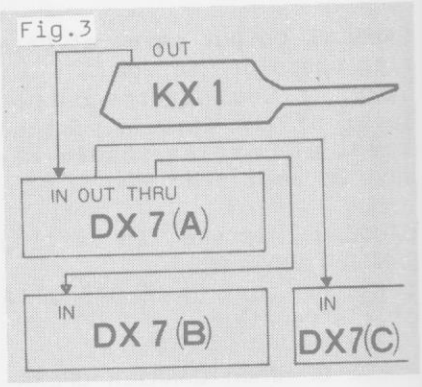


The REAL TIME INFORMATION from the KX 1 controls both DX7(A) and (B) so DX7(B) can't be controlled by DX7(A).

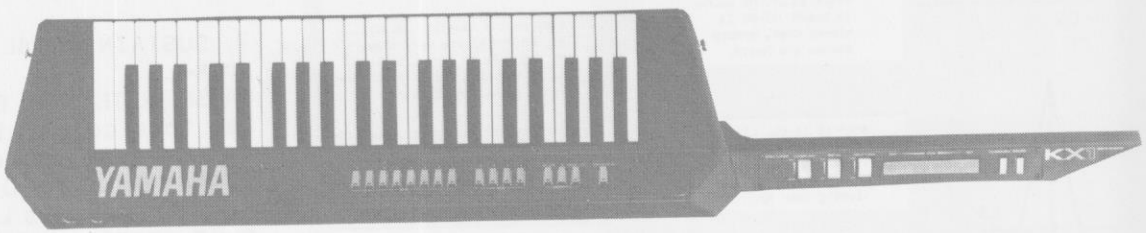
If they are connected as shown in Fig.3 it is possible for KX 1 to control both DX 7 (A) and (B) or DX7(A) to control DX7(C).

When KX 1 is used it is necessary to make sure that any desired sound may always be obtained by putting the memory of INTERNAL and CARTRIDGE in order beforehand. Especially in the case of a remote performance, the success of a performance depends on how fast and precisely players can push the SELECT switch.

Fig.3



REMOTE KEYBOARD KX 1



APPENDIX PART 4

ENHANCED USAGE OF DX BY MIDI TERMINAL

The function of DX can be enhanced by connecting it with external devices and the key point to this is the MIDI TERMINAL on the rear panel.

The MIDI TERMINAL offers various possibilities such as use in tandem with several DXs or connection to a computer.

MIDI STANDARD EXTENDING THE POTENTIAL OF THE MUSICAL INSTRUMENT

Another feature of the DX series is that it is provided with MIDI STANDARD.

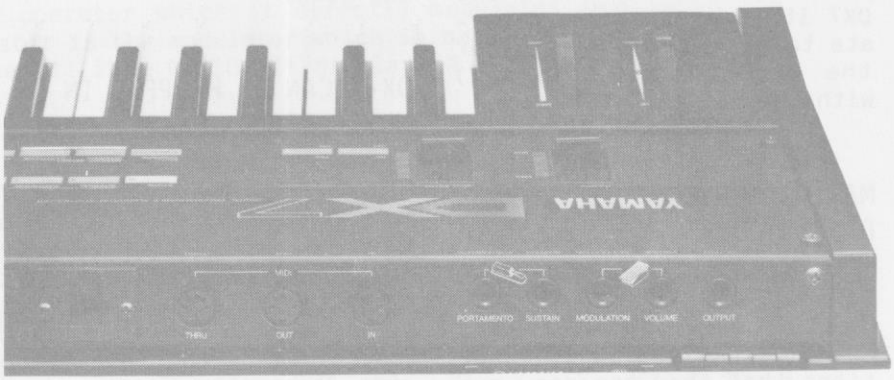
The rear panel has three DIN JACKS marked MIDI IN, MIDI OUT and MIDI THRU. These three jacks give unlimited possibilities.

The MIDI standard is a standard by which various electronic data generated at the time of a musical performance is unified. The heights and lengths of tones when keys are played, the weight of touch, switching of the present tone colour by panel operation, movement of wheels, pedalling, volume pedals and sustain pedals, etc., may all be expressed as MIDI STANDARD data. But as this standard is also common among makers of musical instruments, the same data can be used not only for the DX but also for any instrument provided with MIDI STANDARD. Therefore, if this is used effectively, the potential may be unlimited.

SIMULTANEOUS PERFORMANCE OF SEVERAL INSTRUMENTS

First, simultaneous performance of several instruments is possible. This is explained in Chapter 2.

▼ DX-7 REAR PANEL



The MIDI OUT TERMINAL of a DX-7 is connected with the MIDI IN TERMINAL of another DX-7 (this can be any other keyboard installed with MIDI STANDARD) by means of a MIDI cable (a five pin DIN cable is suitable). Thus the second DX-7 can be made to generate the same tones as the one being played.

As the DX7 has a THRU TERMINAL, three, four or even more units can be connected. If the tone of each instrument is changed one person may play as if he were conducting an orchestra.

Until now, it has only been possible to synchronize certain instruments such as drum machines and sequencers but it has now become possible for any instrument installed with MIDI STANDARD to be synchronized.

CONNECTION WITH A COMPUTER IS KEY TO DEVELOPMENT

The most noteworthy point here is that a MIDI STANDARD keyboard may be connected to a computer. There are many instances of this such as the connection of a synthesizer and computer but these are rarely done because of the expense, and computers must be modified or specially made etc.

However, a MIDI STANDARD has made it possible to connect instruments and computers with ease. A computer has various functions according to the programming software and this is also the limiting factor when a DX 7 is connected to a computer.

Here are some examples. The first obvious choice is 'Automatic Performance'. If the performance data is composed with a computer and sent to a DX7 it is performed faithfully. If the data is correct there will not be any

mistakes thus making it possible to play some phrases beyond human capability. But there must be some who want to play 'On Line' because the DX7 has a keyboard. If so, it does not all have to be left to the computer. For instance, the computer can be made to play the difficult phrases, thereby leaving the easy parts to the performer

The DX7 does not have such functions as AUTO ARPEGGIO and AUTO RHYTHM. These are also a kind of automatic performance and with the help of the computer they may be performed at will. With the DX7 it is possible to generate tones beyond the range of the keyboard (128 in all) with the help of MIDI.

MAKING THE BEST USE OF A DISPLAY DEVICE

Personal computers are now so rich in graphic functions that they can draw out remarkably clear pictures and outstanding visual effects. Now on the market are many devices which can videotape and superimpose. This means more elaborate things may be tried such as synchronizing with light or connecting with a laser.

People wishing to make tone colour data with the help of a computer will find it easy to draw different kinds of parameters and to catch the whole image of tone colour on the screen of a personal computer. If the numerical value of a parameter is decided it is only necessary to send it to the RAM of the DX7, and if the data is stored by the computer (disc or tape), drowning out sounds can be prevented and an unlimited number of tone colours may be achieved. Moreover, some different tone colours may be easily discovered by changing parameters and comparing them.

It is possible to compose and arrange using the combination of a DX7 and a computer.

A computer may well give ideas for introductions and endings.

Multiple recordings are possible using a computer. In this case the problem of hysteresis seems to be solved.

It is also possible to change keys without changing tempo after recording.

Moreover if music for arrangement is saved by the computer, it is possible to reproduce the score, or part of it, and print it out at any time.

DX-7 CAN BE HELPFUL IN MUSIC LESSONS

There must be those who want to buy a DX7 and study the keyboard in earnest but who are suffering from not being able to find a good teacher or having to pay too much for tuition. Software is capable of solving these problems. Self training in rhythm and pitch now becomes possible with the use of suitable software.

It is also possible to learn music theory hearing real tones and actually playing. As the DX7 is excellent in touch response it is ideal for developing finger co-ordination and strength.

The DX7 is ideal for KARAOKE fans (singing a song with accompaniment by tape recorder). It is ideal because it creates data for automatic performance which may be corrected or modified afterwards. It is possible to have text on the screen of a computer.

Not only is it possible to enjoy composition and musical education by using the DX7 and a computer, but the range of possibilities may well be expected to widen in the future such as in the composing of colour tone parameters, computer composition on the basis of pictures and words, etc..

COMPUTER ESPECIALLY FOR MUSIC

Many computers for music have appeared on the market such as that manufactured by Yamaha which has an excellent function for music and is connected with the FM SYNTHESIZER UNIT (SFG-01) where the computer changes to an EIGHT TONE POLYPHONIC SYNTHESIZER. As the sound source is FM, the same as with the DX series, computer music of a high quality may be enjoyed.

This unit can also be connected with the mini keyboard YK-01 and can be used for real playing because it is provided with performance software for rhythm and auto-bass functions and for the tone colour combination of FM sound source etc. As it has MIDI standard it can also be connected with the DX7.

APPENDIX PART 5

INTERNAL VOICE DATA LIST FOR INTERNATIONAL VERSION

This DATA LIST for the 32 TONE COLOURS of
INTERNAL VOICE is for reference when editing.

HOW TO READ DATA LIST

- Only the parts difficult to understand are explained.

1 Number of each operator.
2 C is the case where the operator is a Carrier. Where it is a modulator, the number indicates the operator which it directly modulates (e.g. when the number is 1 the operator is the modulator which is modulating OP1).
3 Mode of operator. When it is a RATIO, it displays R and when it is Fixed, it displays F.
4 Detune.
5 Rate scaling.
6 Key velocity sensitivity.
7 Amplitude modulation sensitivity.

ALGORITHM: #10	TRANSPOSE: MIDDLE C = C 1	F.B. LEVEL: 0	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
32	30	94	16	50	7	81	99	SAW+	65	0	0	0	ON	5

# ❶	ALS ❷	❸ M	OSC FREQ	❹ D	ENVELOPE R1	R2	R3	R4	L1	L2	L3	L4	KBD SCALE ❺ LD	LC	BP	RD	RC	R	❻S V	❼S M	OL
6	4	N	0.500	+0	89	22	20	41	99	92	0	0	0	−L	A −1	0	−L	0	0	0	99
5	4	N	2.020	+0	88	24	23	37	99	90	0	0	0	−L	A −1	0	−L	0	0	0	96
4	C	N	0.500	+0	13	14	20	30	99	95	99	0	0	−L	A −1	0	−L	0	0	0	99
•3	2	N	6.060	+0	76	35	99	11	67	38	73	0	0	−L	A −1	0	−L	0	0	0	99
2	1	N	1.000	+0	82	80	19	14	80	95	0	0	0	−L	A −1	0	−L	0	0	0	96
1	C	N	4.040	+0	9	14	17	34	61	96	0	0	0	−L	A −1	0	−L	0	0	0	99

■VOICE NAME : BRASS 1

ALGORITHM: #22	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 7	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
84	95	95	60	50	50	50	50	SIN	37	0	5	0	OFF	3

#	ALS	OSC M	FREQ	D	ENVELOPE R1	R2	R3	R4	L1	L2	L3	L4	KBD SCALE LD	LC	BP	RD	RC	R	S V	M	OL
•6	345	N	1.000	+0	49	99	28	68	98	98	91	0	54	−E	C 3	50	−E	4	2	0	82
5	C	N	1.000	+1	77	36	41	71	99	98	98	0	0	+L	C 3	0	+L	0	2	0	98
4	C	N	1.000	+0	77	36	41	71	99	98	98	0	0	+L	C 3	0	+L	0	2	0	99
3	C	N	1.000	−2	77	76	82	71	99	98	98	0	0	+L	C 3	0	+L	0	2	0	99
2	1	N	0.500	+7	62	51	29	71	82	95	96	0	0	+L	C 2	7	−E	0	0	0	86
1	C	N	0.500	+7	72	76	99	71	99	88	96	0	0	+L	C 3	14	+L	0	0	0	98

- Of interest as to data is the Envelope of OP2 and it increases thus:
L1 → L2 → L3.
- Setting of R1 of each operator becomes a good reference for brass sounds. When the R1s of OP3, OP4 and OP5 of Carrier are faster than those of the list, the Attack Sound of the sine wave becomes audible and, when slower, it becomes that of strings.
- Level Scaling of OP6 prevents the tone colour from becoming indelicate. The reason why Attack is clearly audible in spite of R1 of OP6 being comparatively low (49) is that Rate Scaling is 4.

■VOICE NAME : BRASS 2

ALGORITHM: #22	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 7	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
84	95	95	60	50	50	50	50	SIN	37	0	0	0	OFF	3

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
•6	345	N	0.500	+0	99	39	32	71	99	98	88	0	0	+L	C 4	0	+L	0	0	0	80
5	C	N	0.500	+1	99	39	32	71	99	98	81	0	0	+L	C 3	0	+L	0	0	0	99
4	C	N	0.500	−2	99	39	32	71	99	98	81	0	0	+L	C 3	0	+L	0	0	0	99
3	C	N	0.500	−3	99	39	32	71	99	98	81	0	0	+L	C 3	0	+L	0	0	0	99
2	1	N	0.500	+7	99	39	32	71	99	98	80	0	0	+L	C 4	38	+L	0	0	0	84
1	C	N	0.500	+7	99	39	32	71	99	98	80	0	0	+L	C 4	38	+L	0	0	0	99

- This Envelope for brass is very different and the R1 of each operator which ought to produce the brass sound is the maximum 99. If the output level and frequency ratio are correct, the sound is somewhat like brass, but if there is a difference of one step, the feeling of brass is lost. In a performance it has an atmosphere more keyboard like and more similar to synthesizer brass than to real brass.
- For editing this sound, refer to Chapter 3, Item 2 'EXAMPLE OF REAL EDIT'.

■VOICE NAME : BRASS 3

ALGORITHM: #18	TRANSPOSE: MIDDLE C = C 2	F.B. LEVEL: 6	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
94	67	95	60	50	50	50	50	TRI	35	0	5	0	OFF	3

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	C	N	8.470	+0	77	56	20	70	99	0	0	0	0	−L	A −1	0	−L	7	0	0	79
5	1	N	3.180	−1	48	55	22	50	98	61	62	0	0	−L	A −1	0	−L	0	0	0	70
4	1	N	1.000	+0	66	92	22	50	53	61	62	0	0	−L	A −1	0	−L	0	0	0	79
•3	1	N	1.000	+0	46	35	22	50	99	86	86	0	0	−L	A −1	0	−L	1	1	0	77
2	4	N	1.000	+0	37	34	15	70	85	0	0	0	0	−L	A −1	0	−L	2	1	0	70
1	5	N	1.000	+0	55	24	19	55	99	86	86	0	0	−L	A −1	0	−L	2	2	0	99

- The key points of this sound, are the settings of F FINE for OP5 and OP6. Without these two the 'cracked' feeling of this noise at the time of taking a breath would be lost. Increasing the output level of OP5 and OP6 and using key velocity can make the 'cracked' feeling strong only when using strong attack.
- To obtain a clear tone colour, increase the output levels of OP2 to OP4.
- To obtain a sharp attack, make R1 of OP1 to OP6 larger by about 10 to 20.

■VOICE NAME : STRINGS 1

ALGORITHM: #2	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 7	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
94	67	95	60	50	50	50	50	TRI	30	0	8	0	OFF	2

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	5	N	14.000	+0	53	19	20	54	99	92	86	0	0	−L	A −1	0	−L	2	2	0	53
5	4	N	3.000	+0	53	19	20	54	86	92	86	0	0	−L	A −1	0	−L	2	2	0	84
4	3	N	1.000	+0	96	19	20	54	99	92	86	0	0	−L	A −1	0	−L	2	2	0	77
3	C	N	1.000	+0	44	45	20	54	99	85	82	0	0	−L	F 4	97	−L	0	7	0	86
•2	1	N	1.000	+0	75	71	17	49	82	92	62	0	0	−L	D# 4	0	−L	1	0	0	83
1	C	N	1.000	+0	45	24	20	41	99	85	70	0	0	−L	A −1	0	−L	2	3	0	99

- This generates the harmonic contents of strings using an algorithm of 4 stages. The frequency of OP6 is very high.
- For editing this sound refer to Chapter 3, Item 2 'EXAMPLE OF REAL EDIT'.

■VOICE NAME : STRINGS 2

ALGORITHM: #2	TRANSPOSE: MIDDLE C = C 2	F.B. LEVEL: 7	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
84	95	95	60	50	50	50	50	SIN	30	81	8	0	OFF	2

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	5	N	8.000	+0	72	76	10	32	99	92	0	0	0	−L	A −1	0	−L	0	0	0	70
5	4	N	2.000	+0	76	73	10	28	99	92	0	0	0	−L	A −1	0	−L	0	0	0	66
4	3	N	2.000	+0	49	74	10	32	98	98	36	0	0	−L	B 7	0	−L	0	0	0	76
3	C	N	2.000	+6	51	15	10	47	99	92	0	0	0	−L	A −1	0	−L	0	0	0	92
•2	1	N	2.000	−6	81	13	7	25	99	92	28	0	0	−L	A −1	0	−L	0	0	0	74
1	C	N	2.000	+0	48	56	10	47	98	98	36	0	0	−L	B 7	0	−L	0	0	0	92

- Of all the string sounds the DX can produce, this is the most realistic. The sound includes high-order harmonics because only OP6 has four times frequency of the carrier. When this frequency is decreased the total tone colours are rounded off.
- The ENVELOPE and LEVEL SETTING is almost linear and this is a typical pattern used for making strings, setting the speed of RATE 1 of Carrier OP1 and OP3.

■VOICE NAME : STRINGS 3

ALGORITHM: #15	TRANSPOSE: MIDDLE C = C 2	F.B. LEVEL: 7	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
94	67	95	60	50	50	50	50	SIN	28	46	30	0	OFF	1

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	4	N	14.000	+0	53	64	44	54	99	92	56	0	25	+L	E 4	0	−L	2	2	0	54
5	4	N	3.000	+0	53	67	38	54	86	92	74	0	0	−L	A −1	0	−L	2	1	0	84
4	3	N	1.000	+0	96	19	20	54	99	92	89	0	0	−L	A −1	0	−L	2	2	0	75
3	C	N	1.000	+0	50	52	35	41	99	92	91	0	98	+L	C 4	60	−L	2	1	0	99
•2	1	N	1.000	+0	99	71	35	51	82	92	87	0	0	−L	D# 4	0	−L	1	0	0	86
1	C	N	1.000	+0	52	30	25	43	99	92	90	0	0	−L	A −1	0	−L	2	1	0	99

- This setting realistically produces the sound of 'bowed' strings, but since the ENVELOPE is assembled to render clearly the tone colour variation, and the LEVEL SETTING of the modulators OP2 and OP5 is similar to BRASS and if the execution time of R1 and R2 of OP2 is slowed down, after all that the tone colour of BRASS will be produced. In short, it will be a good reference for different types of ENVELOPE SETTING.
- There is no special reason for SCALING +LIN DEPTH 98 of L KEY of the Carrier OP3.

■VOICE NAME : ORCHESTRA

ALGORITHM: #2	TRANSPOSE: MIDDLE C = C 2	F.B. LEVEL: 7	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
84	95	95	60	50	50	50	50	SIN	30	63	6	0	OFF	3

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	5	N	2.000	+0	72	76	10	32	99	92	0	0	0	−L	A −1	0	−L	0	0	0	82
5	4	N	2.000	+0	76	73	10	55	99	92	0	0	0	−L	A −1	0	−L	0	0	0	80
4	3	N	2.000	+0	56	74	10	45	98	98	36	0	0	−L	B 7	0	−L	0	0	0	72
3	C	N	2.000	+6	54	15	10	47	99	92	0	0	0	−L	A −1	0	−L	0	0	0	96
•2	1	N	1.000	−6	53	46	32	61	99	93	90	0	0	−L	A −1	0	−L	0	0	0	83
1	C	N	1.000	+0	80	56	10	45	98	98	36	0	0	−L	B 7	0	−L	0	0	0	99

- This generates two tone colours simultaneously but it is a rather coarse sound. Since the tone colour changes are too fast at the time of the ATTACK with the brass sound, it will be necessary to control the output level.
- Since the RATE 4 of the Carrier OP1 is less than RATE 4 of Modulator OP2, release sound of the sine wave will remain for a long time after the key is released. It is necessary to reduce the difference in size of the RATE 4s.

■VOICE NAME : PIANO 1

ALGORITHM: #19	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 6	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
94	67	95	60	50	50	50	50	TRI	35	0	0	0	OFF	4

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
•6	45	N	1.000	−1	99	0	25	0	99	75	0	0	0	−L	A −1	10	−L	5	0	0	82
5	C	N	1.580	−1	81	58	36	39	99	14	0	0	0	−L	A 3	66	−L	5	1	0	93
4	C	N	1.000	+1	81	23	22	45	99	78	0	0	0	−L	A −1	0	−L	5	2	0	99
3	2	N	3.000	+0	81	25	25	14	99	99	99	0	32	+L	G# 3	74	−L	5	0	0	57
2	1	N	1.000	+2	99	0	25	0	99	75	0	0	0	−L	A −1	13	−L	5	0	0	87
1	C	N	1.000	−2	81	25	20	48	99	82	0	0	85	+L	A −1	0	−L	4	2	0	99

- This is a comparatively elegant piano sound but it is recommended that slightly more KEY VELOCITY be applied.
- Since the ENVELOPE of modulator OP3 has L1 to L3 in series, any value may be used for RATE 2 and 3. Imagine that this OPERATOR does the fine tuning of the tone made by OP2 → OP1.
- There is no reason for SCALING +LIN DEPTH 85 of L KEY of the Carrier OP1.

■VOICE NAME : PIANO 2

ALGORITHM: #18	TRANSPOSE: MIDDLE C = C 2	F.B. LEVEL: 5	OSC KEY SYNC: OFF

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
94	67	95	60	50	50	50	50	TRI	30	0	0	0	OFF	4

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	5	N	0.500	+1	92	71	58	36	99	0	0	0	0	−L	A 2	98	−L	3	1	0	78
5	4	N	0.500	+0	90	71	33	31	99	0	0	0	0	+E	C 2	26	−L	3	1	0	94
4	1	N	1.000	−1	97	27	10	25	99	86	48	0	0	−L	A −1	0	−L	3	1	0	84
•3	1	N	5.000	+1	90	27	20	50	99	85	0	0	0	−L	F 2	27	−L	5	1	0	83
2	1	N	1.000	+2	95	0	25	0	99	75	0	0	0	−L	A −1	10	−L	2	1	0	86
1	C	N	1.000	+0	80	24	10	50	99	62	0	0	0	−L	A −1	0	−L	3	2	0	94

- Refer to Chapter 3, Item 2 'ACTUAL EDIT EXAMPLE'.

■VOICE NAME : PIANO 3

ALGORITHM: # 3	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 4	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
0	0	0	0	50	50	50	50	TRI	45	0	0	0	OFF	4

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
•6	5	N	0.500	+2	80	73	15	10	99	19	0	0	0	−L	D 4	0	+L	3	5	0	84
5	4	N	1.000	−2	98	20	6	2	91	90	0	0	0	+L	D 3	27	−L	2	1	0	87
4	C	N	1.000	+3	90	64	28	45	99	97	0	0	0	−L	G 3	0	−L	3	2	0	95
3	2	N	7.000	−3	94	80	19	12	83	67	0	0	9	+L	E 3	20	−L	3	3	0	97
2	1	N	1.000	+4	98	36	6	32	91	90	0	0	22	+L	B 3	50	−L	2	0	0	85
1	C	N	1.000	−4	90	30	28	45	99	95	0	0	0	−L	F 2	0	−L	3	3	0	86

- This sound is like the old HONKY-TONK piano. The feeling of this unfinished sound will be generated at F COARSE 7.00 of the modulator OP3. If the output level of modulator OP2 is smaller than that of modulator OP3, OP1 which is F COARSE 1.00 has less effect on the Carrier OP2.
- It is more effective to apply the KEY VELOCITY to the modulators OP2 and OP5 which directly modulate the Carrier.

■VOICE NAME : E. PIANO 1

ALGORITHM: #5	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 6	OSC KEY SYNC: OFF

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
94	67	95	60	50	50	50	50	SIN	34	33	0	0	OFF	3

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
•6	5	N	1.000	+7	95	29	20	50	99	95	0	0	0	−L	D 3	19	−L	3	6	0	79
5	C	N	1.000	−7	95	20	20	50	99	95	0	0	0	−L	A −1	0	−L	3	0	0	99
4	3	N	1.000	+0	95	29	20	50	99	95	0	0	0	−L	A −1	0	−L	3	6	0	89
3	C	N	1.000	+0	95	20	20	50	99	95	0	0	0	−L	A −1	0	−L	3	2	0	99
2	1	N	14.000	+0	95	50	35	78	99	75	0	0	0	−L	A −1	0	−L	3	7	0	58
1	C	N	1.000	+3	96	25	25	67	99	75	0	0	0	−L	A −1	0	−L	3	2	0	99

• This is a beautiful Electric Piano sound using a typical sound making method with Algorithm 5. OP2 → OP1 gives the striking sound, OP4 → OP3 gives change of tone colour by key touch and OP6 → OP5 gives a little change in the tone colour.

■VOICE NAME : GUITAR 1

ALGORITHM: #8	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 7	OSC KEY SYNC: OFF

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
75	80	75	60	50	50	50	50	SIN	35	0	1	3	OFF	3

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	5	N	12.000	+0	99	57	99	75	99	0	0	0	53	−L	C 3	20	−L	0	6	3	57
5	3	N	3.000	+0	81	87	22	75	99	92	0	0	0	−L	A −1	15	−L	4	7	0	99
•4	3	N	3.000	+0	81	87	22	75	99	92	0	0	0	−L	A −1	14	−L	4	4	0	89
3	C	N	1.000	+0	78	87	22	75	99	92	0	0	9	−L	G 2	0	−L	3	7	0	99
2	1	N	3.000	+0	91	25	39	60	99	86	0	0	0	−L	A −1	65	−L	2	7	0	93
1	C	N	1.000	+0	74	85	27	70	99	95	0	0	0	−L	A −1	0	−L	4	5	0	99

• This is a real JAZZ guitar. Since strong KEY VELOCITY is also applied to OP1 and OP3 of the Carrier, the width of sound volume and tone colour from TOUCH are greater and it will be possible to get a dynamic sound which is almost the real thing. The ENVELOPE is simple and R3 has a long decreasing pattern.

■VOICE NAME : GUITAR 2

ALGORITHM: #16	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 7	OSC KEY SYNC: OFF

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
84	95	95	60	50	50	50	50	TRI	35	0	0	0	OFF	4

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	5	N	3.000	+0	99	44	1	71	99	96	75	0	0	+L	A 4	46	−L	0	2	0	73
5	1	N	0.500	+0	99	99	12	0	99	99	76	0	0	+L	A 4	0	−L	0	7	0	85
4	3	N	0.500	+0	92	99	15	71	99	96	75	0	0	+L	A 4	0	−L	0	0	0	70
3	1	N	1.500	+0	99	99	99	71	99	99	99	0	0	+L	C 3	40	−L	0	7	0	99
2	1	N	1.000	+0	99	99	99	42	99	99	99	99	0	+L	A 3	0	−L	1	7	0	87
•1	C	N	3.000	+0	95	67	99	71	99	99	99	0	82	+L	A −1	0	+L	0	2	0	86

• This is the DISTORTION guitar although slightly different in nuance. The fundamental tone composition is generated by setting F COARSE of the modulation lower than that of the Carrier but it will be weak if this method is used, and it will produce a somewhat 'chirping' sound. If played at high volume the upper harmonics will become unpleasant.

• Refer to Chapter 3, Item 4 'MAKING SOUND OVER AND OVER' for the sound of DISTORTION guitar.

■VOICE NAME : SYN-LEAD 1

ALGORITHM: #18	TRANSPOSE: MIDDLE C = C 4	F.B. LEVEL: 7	OSC KEY SYNC: OFF

PITCH ENVELOPE								LFO					
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
0	0	0	0	50	50	50	50	SIN	37	42	0	99	OFF	4

#	ALS	OSC			ENVELOPE								KBD SCALE							S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R		V	M	
6	5	N	17.000	+0	99	70	60	0	99	99	97	0	0	−L	F 2	21	−L	3		0	0	47
5	4	N	3.000	−2	99	99	97	0	99	65	60	0	0	−L	F 2	0	−L	1		0	0	43
4	1	N	2.000	+2	99	92	28	60	99	90	0	0	0	−L	A 3	60	−L	6		0	0	71
•3	1	N	1.000	+0	99	87	0	0	93	90	0	0	0	−L	F 2	21	−L	3		0	0	82
2	1	N	1.000	−1	99	95	0	0	99	96	89	0	0	−L	F 2	0	−L	3		0	0	71
1	C	N	1.000	+1	99	0	12	70	99	95	95	0	0	−L	F 2	0	−L	1		0	0	99

• SYNTHESIZER LEAD. If this sound is too loud it becomes unpleasant. Therefore it would be better if MIDDLE C = C4 be set to C3.

■VOICE NAME : BASS 1

ALGORITHM: #16	TRANSPOSE: MIDDLE C = C 2	F.B. LEVEL: 7	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO					
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
94	67	95	60	50	50	50	50	TRI	35	0	0	0	OFF	3

#	ALS	OSC			ENVELOPE								KBD SCALE							S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R		V	M	
•6	5	N	9.000	+0	94	56	24	55	93	28	0	0	0	−L	A −1	0	−L	1		7	0	85
5	1	N	0.500	+0	99	0	0	0	99	0	0	0	75	−L	C# 4	0	−L	7		3	0	62
4	3	N	5.000	+0	90	42	7	55	90	30	0	0	0	−L	A −1	0	−L	5		5	0	93
3	1	N	0.500	+0	88	96	32	30	79	65	0	0	0	−L	A −1	0	−L	6		3	0	99
2	1	N	0.500	+0	99	20	0	0	99	0	0	0	0	−L	D 3	0	−L	7		0	0	80
1	C	N	0.500	+0	95	62	17	58	99	95	32	0	57	+L	A 2	14	−L	7		0	0	99

• This is a real CHOPPER BASS. Playing this whilst keeping the key depressed will dampen the sound, but striking the key heavily will produce a beautiful CHOPPER feeling because of the effect of KEY VELOCITY on OPs 3 to 6 of the modulator. OP4 and OP6 produce good steel strings, OP4 makes a striking sound and OP6 makes the hum of the strings.

■VOICE NAME : BASS 2

ALGORITHM: #17	TRANSPOSE: MIDDLE C = C 2	F.B. LEVEL: 7	OSC KEY SYNC: OFF

PITCH ENVELOPE								LFO					
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
94	67	95	60	50	50	50	50	SIN	31	33	0	0	OFF	2

#	ALS	OSC			ENVELOPE								KBD SCALE							S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R		V	M	
6	5	N	0.500	+1	25	50	24	55	96	97	0	0	0	−L	A −1	0	−L	3		7	0	87
5	1	N	1.010	+0	99	51	0	0	99	74	0	0	0	−L	G 2	32	−L	4		2	0	75
4	3	N	0.500	+0	80	39	28	53	93	57	0	0	0	−L	A −1	0	−L	3		2	0	99
3	1	N	1.000	+7	73	25	32	30	97	78	0	0	0	−L	A −1	0	−L	3		3	0	68
•2	1	N	0.515	+0	28	37	42	50	99	0	0	0	0	−L	D 3	35	−L	1		2	0	80
1	C	N	0.505	+0	75	37	18	63	99	70	0	0	0	−L	A 3	32	−L	3		2	0	99

• When a key is pressed the strings are given a humming sound. This is because RATE 1 of OP2 and OP6 of the modulator will be very slow at 28 and 25. Therefore the effects of OP2 and OP6 are generated at the time the other modulator ends damping after the key is turned ON. (Actually this is almost the effect of OP2). Use this as a handy reference for such settings.

■VOICE NAME : E. ORGAN 1

ALGORITHM: #32	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 0	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
75	80	75	60	50	50	50	50	TRI	35	0	0	0	OFF	4

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
•6	C	N	3.000	+0	99	54	22	90	99	0	0	0	0	−L	A −1	0	−L	0	0	0	94
5	C	N	1.000	+2	99	80	22	90	99	99	99	0	0	−L	A −1	0	−L	0	0	0	94
4	C	N	0.500	+5	99	80	22	90	99	99	99	0	0	−L	A −1	0	−L	0	0	0	94
3	C	N	1.500	+4	99	80	54	82	99	99	99	0	0	−L	A −1	0	−L	0	0	0	94
2	C	N	1.010	−6	99	20	22	90	99	99	97	0	0	−L	A −1	10	−L	0	0	0	94
1	C	N	0.500	−2	99	80	22	90	99	99	99	0	0	−L	A −1	0	−L	0	0	0	94

• This is a simple ORGAN TONE of synthetic sine wave. Only OP6 has an ENVELOPE SETTING (to produce a click sound). It is a beautiful sound but lacks power and will not therefore be suitable to use for Hard Rock.
• With an eye on the DETUNE effect, F COARSE of OP2 is set at 1.01 but even setting at 1.00 would be acceptable.

■VOICE NAME : PIPES 1

ALGORITHM: #19	TRANSPOSE: MIDDLE C = C 2	F.B. LEVEL: 7	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
94	67	95	60	50	50	50	50	SIN	34	33	0	0	OFF	2

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
•6	45	N	10.000	+0	72	25	25	70	99	99	99	0	10	−L	G 3	1	+L	3	2	0	75
5	C	N	2.000	+0	61	25	25	61	99	99	93	0	0	−L	A −1	0	−L	3	0	0	97
4	C	N	4.000	+0	61	25	25	50	99	99	97	0	10	−L	A 4	10	−L	3	0	0	88
3	2	N	1.000	+0	99	97	62	47	99	99	90	0	17	+L	G 3	40	−L	5	0	0	75
2	1	N	0.500	+0	99	97	62	47	99	99	90	0	0	−L	A −1	0	−L	4	0	0	90
1	C	N	0.500	+0	45	25	25	36	99	99	98	0	0	−L	D 3	50	−L	5	0	0	99

• This is a harmonic composition with the slight 'discord' peculiar to PIPE ORGANS and is generated by inserting high F COARSE into the Carriers OP4 and OP5 and the modulator OP6. It is well balanced but when the volume is increased the high harmonics tend to screech. Adjust the output level of OP6.

■VOICE NAME : HARPSICH 1

ALGORITHM: #5	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 1	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
0	0	0	0	50	50	50	50	TRI	35	0	0	0	OFF	2

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
•6	5	N	6.000	+0	95	72	71	99	99	97	91	98	0	−L	C# 5	55	−L	1	0	0	87
5	C	N	4.000	−1	95	28	27	47	99	90	0	0	0	−L	A# 3	0	−L	3	3	0	83
4	3	N	3.000	+0	95	72	71	99	99	97	91	98	0	−L	C# 5	46	−L	1	0	0	99
3	C	N	1.000	−1	95	28	27	47	99	90	0	0	0	−L	A# 3	0	−L	3	2	0	85
2	1	N	0.500	+0	95	72	71	99	99	97	91	98	0	−L	A# 3	0	−L	1	0	0	99
1	C	N	4.000	+0	95	28	27	47	99	90	0	0	0	−L	A# 3	0	−L	3	2	0	89

• The interesting point of this setting is that the ENVELOPE and LEVEL 4 of OP2, OP4 and OP6 of the modulator are set at 98. Since LEVEL 4 of the Carrier OP1, OP3 and OP5 are set at 0, the sound volume disappears upon releasing the key at RATE 4 = 48. While the sound disappears, the modulation will be deepened instantly at each RATE 4 = 99 from 91 of LEVEL 3 to 98 of LEVEL 4. Immediately after the key is released the click sound will be heard. These procedures are often used in an analog synthesizer but it should be remembered that this is one of the cardinal principles of ENVELOPE SETTING.

■VOICE NAME : CLAV 1

ALGORITHM: #3	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 5	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
0	0	0	0	50	50	50	50	SIN	30	0	0	0	OFF	2

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
•6	5	N	8.000	+0	98	87	0	0	87	86	0	0	0	−L	F 2	21	−L	3	7	0	78
5	4	N	0.500	−2	95	95	0	0	99	96	89	0	0	−L	F 2	0	−L	3	6	0	99
4	1	N	2.000	+0	95	92	28	60	99	90	0	0	0	−L	F 2	0	−L	3	2	0	99
3	2	N	6.000	+0	98	87	0	0	87	86	0	0	0	−L	F 2	21	−L	3	1	0	71
2	1	N	0.500	−1	95	95	0	0	99	96	89	0	0	−L	F 2	0	−L	3	1	0	99
1	C	N	0.500	+1	95	92	28	60	99	90	0	0	0	−L	F 2	0	−L	3	3	0	99

• Refer to Chapter 3, Item 2 'ACTUAL EDIT EXAMPLE'.

■VOICE NAME : VIBE 1

ALGORITHM: #23	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 5	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
99	98	75	60	50	50	50	50	TRI	26	0	0	0	ON	2

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	45	N	14.000	+0	99	48	99	50	99	32	0	0	12	−L	C 3	12	+L	5	7	0	57
5	C	N	1.000	+7	80	85	24	50	99	90	42	0	0	−E	F# 0	0	−E	3	5	0	99
4	C	N	1.000	−7	80	85	24	50	99	90	0	0	0	−E	F# 0	0	−E	3	1	0	99
3	2	N	3.000	+0	80	85	43	50	99	74	0	0	12	−L	C 3	12	+L	4	4	0	72
2	C	N	1.000	+0	80	85	24	50	99	90	0	0	4	−L	C 3	12	+L	2	1	0	99
•1	C	N	4.000	+0	99	28	99	50	99	25	0	0	12	−L	C 3	12	+L	2	7	0	50

• This has a very elegant vibraphone sound and the SETTING procedure looks like that for an ELECTRIC PIANO. One difference from the ELECTRIC PIANO is the way DETUNE is applied and in this case, -7 and +7 DETUNE are applied to the Carriers OP4 and OP5 and the effect of PITCH movement is skilfully employed.

■VOICE NAME : MARIMBA

ALGORITHM: #7	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 0	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
94	67	95	60	50	50	50	50	TRI	35	0	0	0	ON	3

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	5	N	4.520	+0	0	63	55	0	78	78	0	0	0	−L	D 3	0	−L	0	2	0	99
5	3	N	0.750	+0	99	75	0	8	82	48	0	0	0	−L	D# 4	46	−L	0	2	0	93
4	3	N	5.000	+0	99	75	0	82	82	48	0	0	0	−L	D# 4	46	−L	0	2	0	85
3	C	N	0.500	+0	95	33	49	41	99	92	0	0	0	−L	A −1	0	−L	3	1	0	99
2	1	N	3.000	+0	99	72	0	0	82	48	0	0	0	−L	D# 4	46	−L	0	2	0	96
1	C	N	0.500	+0	95	40	49	55	99	92	0	0	0	−L	A −1	0	−L	3	0	0	95

• This is set at RATE 1 = 0 by the ENVELOPE of the modulator OP6. OP6 cannot work at this setting. When RATE 1 is increased the striking sound will become strong. Even if the other operator's operation is entirely finished, when RATE 1 = 0, the amplitude of vibration of OP6 still cannot express the effect.

• F COARSE of OP1 to 5 is set at a harmonic ratio. For a musical instrument which strikes wood, it is not necessary to use an out of normal ratio.

■VOICE NAME : KOTO

ALGORITHM: #2	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 7	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
85	99	75	0	49	50	50	50	SIN	30	40	17	15	ON	2

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	5	N	3.000	+0	82	53	37	48	99	81	0	0	0	−L	A −1	5	−L	6	1	0	81
5	4	N	4.000	+0	91	37	29	29	99	90	0	0	0	−L	A −1	5	−L	6	1	0	83
4	3	N	1.000	+0	90	28	17	39	99	76	0	0	0	−L	G 0	17	−E	6	1	0	82
3	C	N	1.000	+0	94	64	30	33	99	92	0	0	0	−L	A −1	0	−L	5	3	0	99
2	1	N	4.000	+0	99	68	28	48	99	83	0	0	0	−L	A −1	10	−L	6	0	0	99
1	C	N	1.000	+0	94	62	58	34	99	92	0	0	0	−L	A −1	0	−L	6	3	0	90

● When this is played by using PITCH BENDER skilfully, it sounds just like a real KOTO (Japanese harp). This is a very high quality sound. The ENVELOPE is simple and used only for damping. This means that this tone colour is fixed by setting the OUTPUT LEVEL and F COARSE. Use these ideas as a handy reference.

■VOICE NAME : FLUTE 1

ALGORITHM: #16	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 5	OSC KEY SYNC: OFF

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
94	67	95	60	50	50	50	50	TRI	30	23	8	13	OFF	1

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
•6	5	N	1.530	+4	99	64	98	61	99	67	52	0	0	−L	G 3	0	+L	0	2	0	83
5	1	N	2.000	+0	65	38	0	61	99	0	0	0	0	−L	D 4	43	−L	0	0	0	56
4	3	N	2.000	+0	61	25	25	60	99	99	97	0	10	−L	A 4	10	−L	3	0	0	0
3	1	N	1.000	−3	53	38	75	61	88	44	24	0	0	+L	G 3	0	−L	0	0	1	76
2	1	N	1.000	+4	99	97	62	54	99	99	90	0	0	−L	A −1	0	−L	4	2	0	75
1	C	N	1.000	−2	61	67	70	65	93	89	98	0	0	−L	D 3	0	−L	0	2	0	98

● The output level of the modulator OP4 is set at 0. If an operator is not needed it is best that it be turned off. An unusual value, 1.53, is contained in F COARSE of the modulator OP6 but the breath peculiar to a FLUTE will be made when the key is released. If this is too much, turn down the output level of OP6 or turn up the KEY VELOCITY.

■VOICE NAME : ORCH-CHIME

ALGORITHM: #5	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 7	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
99	99	99	99	50	50	50	50	TRI	30	0	5	0	OFF	3

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
•6	5	N	1.000	−7	99	0	0	0	99	99	99	0	0	−L	C 1	0	−E	7	0	0	75
5	C	N	1.000	+7	41	42	71	34	99	99	99	0	0	−L	C 1	0	−E	3	0	0	98
4	3	N	3.140	+0	80	70	9	12	88	80	0	0	0	−L	C 1	0	−E	3	3	0	91
3	C	N	0.500	+0	80	49	17	30	99	95	0	0	0	−L	C 1	0	−E	3	2	0	99
2	1	N	0.500	+5	99	0	0	0	99	99	99	0	0	−L	C 1	0	−E	7	0	0	87
1	C	N	0.500	+5	34	42	71	34	99	99	99	0	0	−L	C 1	0	−E	3	0	0	97

● The low range of strings is made by OP2 → 1, the bell sound is made by OP4 → 3 and the strings in the clear high range are made by OP6 → 5. These are then mixed. Since this is a little 'glittery' the output level should be adjusted accordingly.

■VOICE NAME : TUB BELLS

ALGORITHM: #5	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 7	OSC KEY SYNC: OFF

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
67	95	95	60	50	50	50	50	SAW–	35	0	0	0	OFF	1

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	5	N	2.000	−7	98	91	0	28	99	0	0	0	0	−L	A −1	0	−L	2	0	0	85
5	C	F	323.6	+0	76	78	71	70	99	0	0	0	0	−L	A −1	0	−L	2	5	0	99
4	3	N	3.500	−2	98	12	71	28	99	0	32	0	0	−L	A −1	0	−L	2	0	0	75
3	C	N	1.000	−5	95	33	71	25	99	0	32	0	0	−L	A −1	0	−L	2	0	0	99
2	1	N	3.500	+3	98	12	71	28	99	0	32	0	0	−L	A −1	0	−L	2	0	0	78
1	C	N	1.000	+2	95	33	71	25	99	0	32	0	0	−L	A −1	0	−L	2	0	0	95

● OP5 of the Carrier is fixed and the striking sound of the tubular bells is achieved by OP6 ⟶ 5. Since both OP6 and OP5 are very short ENVELOPES, it will have a hidden effect compared with the output level. Note: A poor quality speaker will not reproduce the sound of OP6 ⟶ 5.

■VOICE NAME : STEEL DRUM

ALGORITHM: #15	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 5	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
50	50	50	50	50	50	50	50	SIN	25	0	10	99	OFF	2

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	4	F	398.1	+0	99	49	28	12	91	82	0	0	0	−L	A −1	0	−L	3	0	0	49
5	4	N	5.320	+0	99	40	38	0	91	82	0	0	0	−L	A −1	0	−L	3	0	0	64
4	3	N	2.000	+7	99	44	50	21	91	82	0	0	0	−L	A −1	0	−L	3	1	0	88
3	C	N	1.000	+0	99	30	35	42	99	92	0	0	0	−L	A −1	0	−L	3	3	0	99
2	1	N	1.700	+0	99	19	20	9	99	87	0	0	0	+E	F# 4	71	−L	2	2	0	64
1	C	N	1.000	+0	99	40	33	38	99	92	0	0	0	−L	A −1	0	−L	4	0	0	99

● This is the sound of the STEEL DRUM. The setting of F COARSE of the modulator OP2 and OP5 is the key point to this. OP6 is FIXED but the sound is almost unaffected due to the extremely low output level. When the output level is increased by a small amount, the kind of effect made when this operator is kept fixed will be appreciated.

■VOICE NAME : TIMPANI

ALGORITHM: #16	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 7	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
99	98	75	60	50	51	50	50	TRI	11	0	16	0	OFF	2

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	5	N	0.780	+0	98	2	26	27	98	0	0	0	0	−L	C 0	0	+E	3	1	0	73
5	1	N	0.500	+0	99	50	26	19	99	0	0	0	0	+L	F 6	0	−E	0	1	0	73
4	3	N	0.875	+0	99	31	17	30	99	75	0	0	0	+L	F 6	0	−E	7	7	0	87
3	1	N	0.680	−3	99	77	26	23	99	72	0	0	0	−L	A −1	0	−E	3	0	0	85
2	1	N	0.500	+3	99	74	0	0	99	0	0	0	0	−L	D 3	0	−E	1	1	0	86
1	C	N	0.500	+0	99	36	98	33	99	0	0	0	0	−L	A −1	0	+L	3	1	0	99

● It may be said that this is a good example of F COARSE setting. The ENVELOPE setting explained in Chapter 3 is used which is realised by staccato PLAYING, and MUTE is applied by keeping the key pressed.
● The KEY VELOCITY of the Carrier may be approximately 2.
● When the output level of the modulator is increased a very eccentric string sound will be produced.

■VOICE NAME : REFS WHISL

ALGORITHM: #18	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 2	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
38	67	95	60	39	50	50	50	S/H	99	0	0	0	ON	6

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	4	F	10.00	+0	94	56	24	55	96	78	0	0	0	−L	A −1	0	−L	1	0	0	78
5	4	F	1.000	+0	99	0	0	0	99	0	0	0	0	−L	D 3	0	−L	0	0	0	64
4	1	F	6607	+0	94	68	24	55	96	89	0	0	0	−L	A −1	0	−L	1	0	0	75
3	1	F	46.77	+0	60	39	8	0	99	99	99	0	0	−L	A −1	0	−L	4	0	0	66
2	1	F	33.88	+0	60	39	28	45	99	99	99	0	0	−L	A −1	0	−L	4	0	0	93
1	C	F	2089	+0	60	39	28	49	99	99	99	0	0	−L	A −1	0	−L	4	1	0	90

- For this sound all the operators are FIXED. This setting is very close to the insect cry introduced in Chapter 3, Item 4 'MAKING SOUND OVER AND OVER'.
- When using PITCH BENDER to change pitch, the effect of a SAMBA WHISTLE is obtained.

■VOICE NAME : VOICE 1

ALGORITHM: #7	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 7	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
18	60	95	60	48	51	50	50	TRI	35	35	11	2	OFF	4

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
•6	5	N	5.100	+1	99	72	48	17	99	99	99	0	0	−L	A −1	0	−L	0	0	0	55
5	3	N	1.010	−1	35	21	36	63	99	90	85	0	0	−L	A −1	0	−L	0	1	0	53
4	3	N	1.020	+3	72	19	41	12	48	58	20	9	0	−L	A −1	0	−L	0	1	0	99
3	C	N	1.000	+7	33	20	53	39	99	94	97	0	0	−L	A −1	0	−L	0	3	0	99
2	1	N	1.000	+0	19	26	53	25	51	61	76	51	0	−L	A −1	0	−L	0	2	2	99
1	C	N	1.000	−7	34	20	53	57	99	94	97	0	0	−L	A −1	0	−L	0	0	0	87

- Refer to Chapter 3, Item 2 'ACTUAL EDIT EXAMPLE'.

■VOICE NAME : TRAIN

ALGORITHM: #5	TRANSPOSE: MIDDLE C = C 3	F.B. LEVEL: 7	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
75	67	95	60	50	50	50	50	TRI	39	0	0	99	OFF	0

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
•6	5	N	5.000	+0	49	17	25	53	99	99	99	98	0	+L	A 2	0	−L	0	0	0	99
5	C	N	9.000	+3	42	17	25	53	99	99	99	99	0	+L	A 2	0	−L	0	0	3	83
4	3	F	977.2	−2	98	29	28	27	99	0	0	0	0	−E	F 1	0	−E	0	0	0	89
3	C	F	371.5	+2	98	29	28	33	99	0	0	0	98	−E	C 8	0	−E	0	0	0	99
2	1	N	3.030	+0	39	13	12	72	99	61	66	0	0	+L	C# 4	0	−L	5	0	0	72
1	C	N	1.640	+0	65	24	19	57	99	85	85	0	0	+L	C 3	98	−L	3	0	0	99

- This is a pleasant effect in which LEVEL SCALING is used. A steam whistle is made by OP2 → 1 and the sound of the railway level crossing bell is made by OP4 → 3. OP1 takes care of the lower end of the scale and OP3 the higher end. OP6 → 5 makes the output level of OP6 maximum and then the noise wave is gained by setting the FEEDBACK to 7, and HOLD is made by putting LEVEL 4 in both of them. The sound of a steam locomotive releasing steam is made by setting the AMPLITUDE MODULATION of the Carrier OP5 to maximum level.

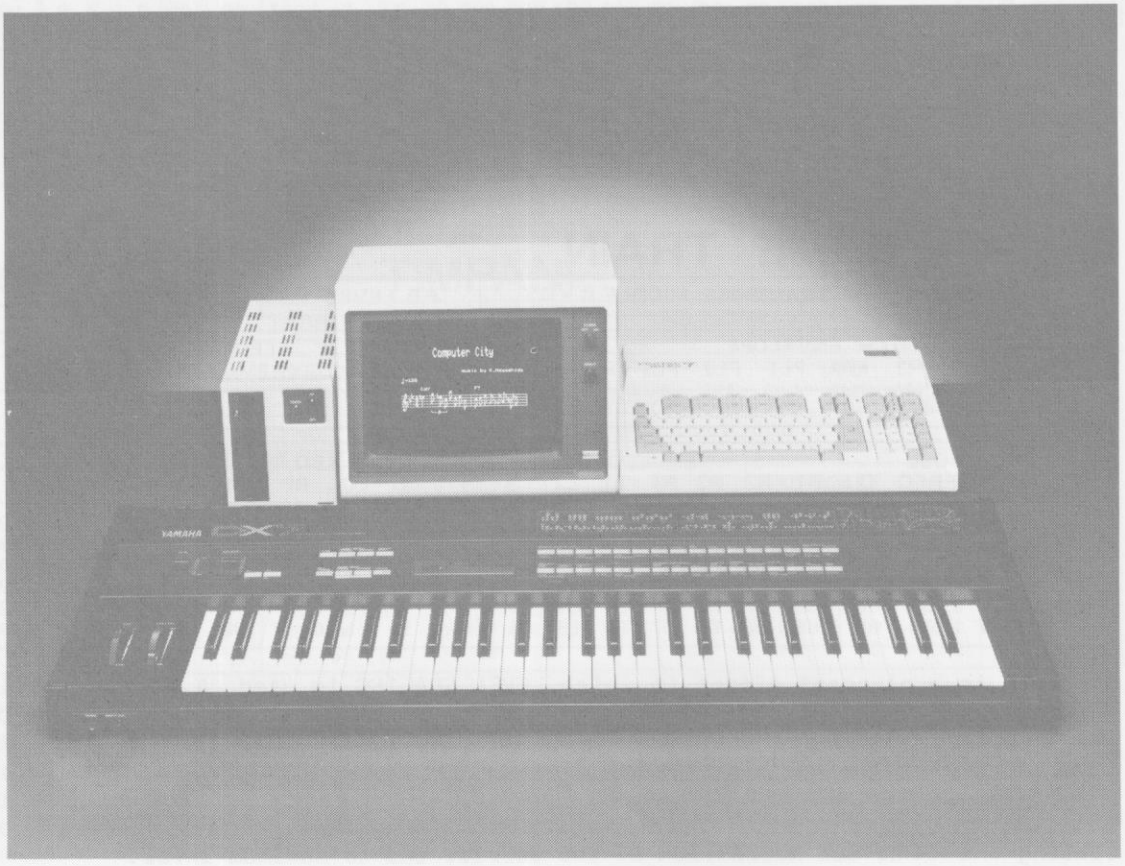
■VOICE NAME : TAKE OFF

ALGORITHM: #10	TRANSPOSE: MIDDLE C = C 1	F.B. LEVEL: 0	OSC KEY SYNC: ON

PITCH ENVELOPE								LFO						
PR1	PR2	PR3	PR4	PL1	PL2	PL3	PL4	WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
32	30	94	16	50	7	81	99	SAW+	65	0	0	0	ON	5

#	ALS	OSC			ENVELOPE								KBD SCALE						S		OL
		M	FREQ	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	V	M	
6	4	N	0.500	+0	89	22	20	41	99	92	0	0	0	−L	A −1	0	−L	0	0	0	99
5	4	N	2.020	+0	88	24	23	37	99	90	0	0	0	−L	A −1	0	−L	0	0	0	96
4	C	N	0.500	+0	13	14	20	30	99	95	99	0	0	−L	A −1	0	−L	0	0	0	99
●3	2	N	6.060	+0	76	35	99	11	67	38	73	0	0	−L	A −1	0	−L	0	0	0	99
2	1	N	1.000	+0	82	80	19	14	80	95	0	0	0	−L	A −1	0	−L	0	0	0	96
1	C	N	4.040	+0	9	14	17	34	61	96	0	0	0	−L	A −1	0	−L	0	0	0	99

● This is a gentle sound among those using PITCH EG. When the SUSTAIN PEDAL is used, the pitch of LEVEL 3 keeps steady while pressing it (an interesting thing is that the hands may be lifted from the keyboard!), and when the foot is removed from the pedal the tone goes up until LEVEL 4 = 99.



A SPECIAL INTRODUCTION TO DX-7 OWNERS IN THE USA

(1) A SPECIAL INTRODUCTION TO DX-7 OWNERS IN THE U.S.A.

Synthesizing the internal voice "BRASS 1".

As you probably already know, there are two versions of the DX-7. The physical construction of the two versions is exactly the same; the difference lies in the types of Internal Voice (32) memorized within the unit. The U.S.A. version differs in tone coloration from the version sold through the rest of the world (except U.S.A.). Individuals owning the U.S.A. version will find some points of divergence between their DX-7 and what is written in the manual. Among these differences, the most often noted is the tone color listed as "Internal Voice 1 - Brass 1". In the U.S.A. version, this is "Flute 1".

In order to store the "Brass 1" tone color within the unit, follow the instructions listed below. The instructions may be somewhat difficult, but if the numerical settings of all parameters are set correctly, anyone can produce this sound. No technical knowledge of the DX-7 itself is required to produce this sound. All that is necessary is for the user to faithfully follow the instructions listed in their proper order. Be sure to study the illustrations as you go, and always confirm the information shown on the LCD (liquid crystal display).

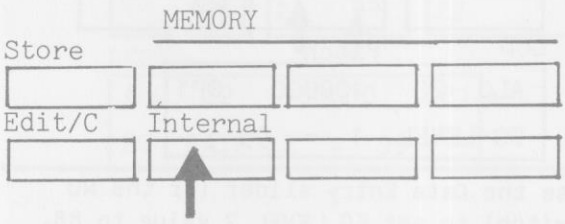
After finishing this procedure, and as you proceed through the manual, you will come to understand the significance of each step performed.

* The data list for the U.S.A. version will be found at the end of the volume.

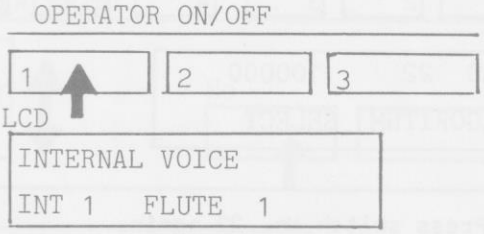
(2) HOW TO STORE 'BRASS 1' SOUND TO YOUR DX-7

1. Switch on

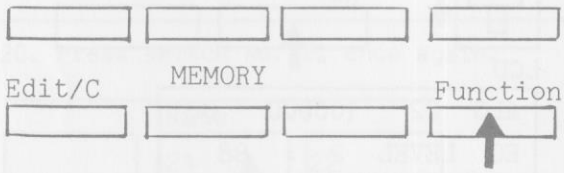
2. Press the Memory Select Internal Switch



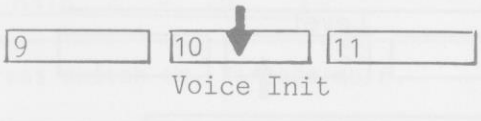
3. Press switch No. 1.



4. Press the Function switch.



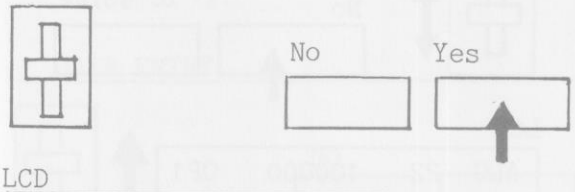
5. Press switch No. 10.



LCD

FUNCTION CONTROL
VOICE INIT?

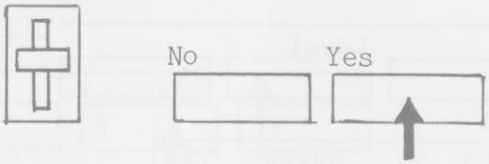
6. Press the Data Entry YES switch.



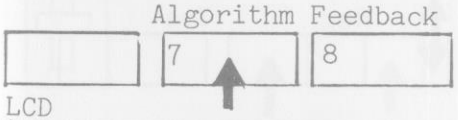
LCD

FUNCTION
ARE YOU SURE?

7. Press the YES switch again.
   * At this point, even if the keys are ON, nothing but sine wave sounds will be heard



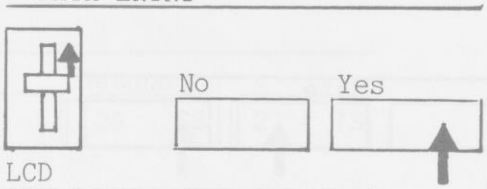
8. Press switch No. 7.



LCD

ALG 1 111111
ALGORITHM SELECT

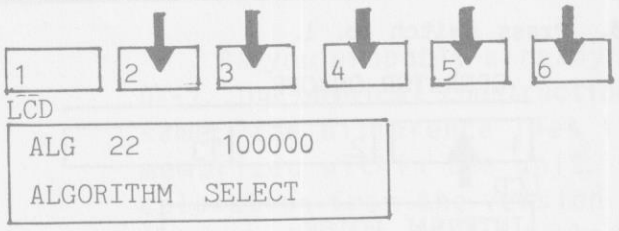
9. Use the Data Entry slider (or the YES switch) to change ALG 1 to ALG 22 (if the YES switch is used for this operation, press it 21 times. Using the slider allows the data to be changed more quickly).



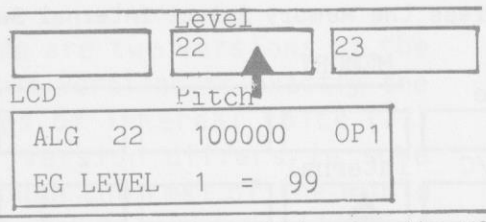
LCD

ALG 22 111111
ALGORITHM SELECT

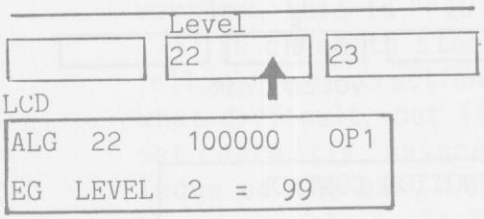
10. Press switches Nos. 2, 3, 4, 5 and 6.



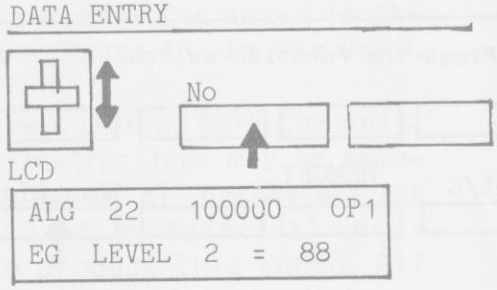
11. Press switch No. 22



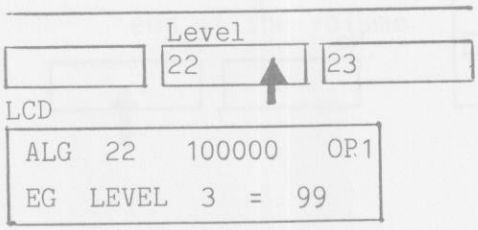
12. Press switch No. 22 again.



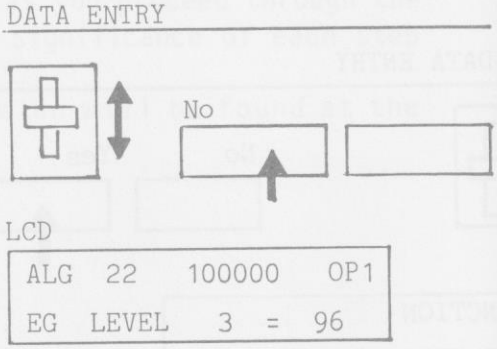
13. Use the Data Entry slider (or the NO switch) to set EG LEVEL 2 value to 88.



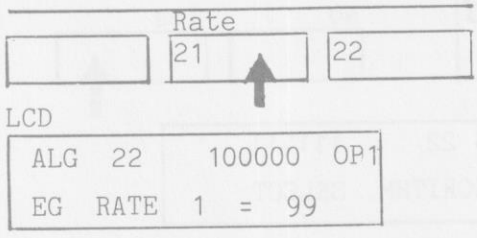
14. Press switch No. 22 again.



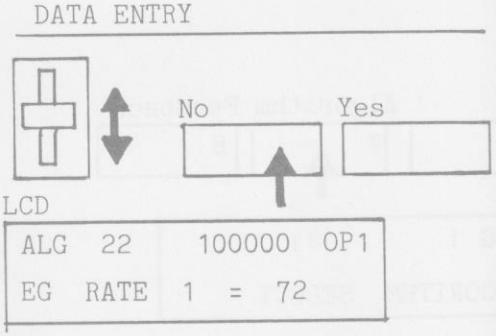
15. Use Data Entry to set the EG LEVEL 3 value to 96.



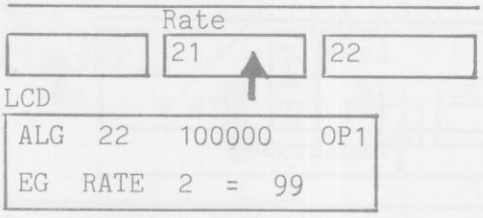
16. Press switch No. 21.



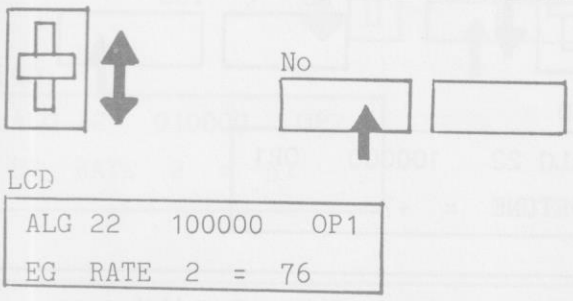
17. Use Data Entry to lower the EG RATE 1 value to 72.



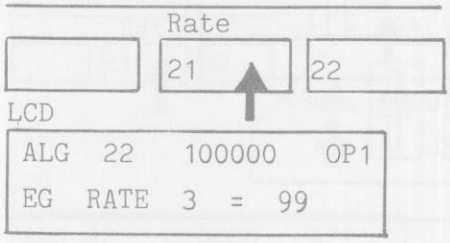
18. Press switch No. 21 again.



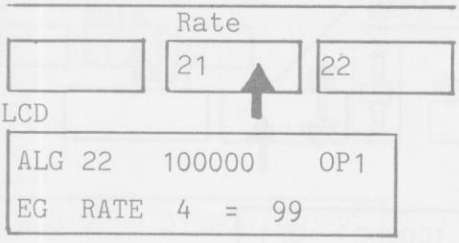
19. Use Data Entry to lower the EG RATE 2 value to 76.



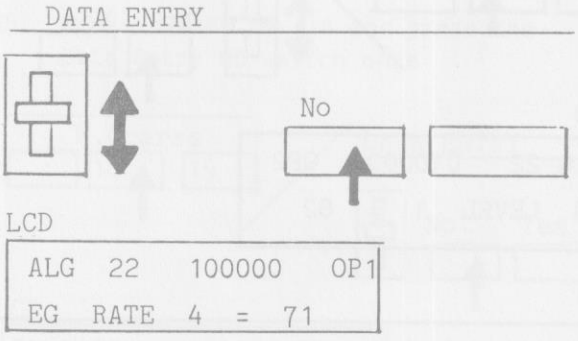
20. Press switch No. 21 once again.



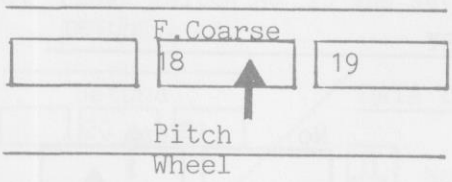
21. Press switch No. 21 once more.



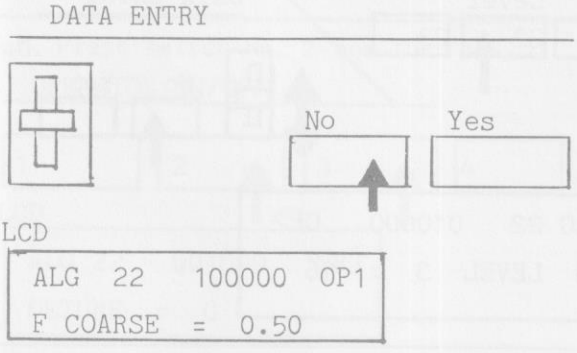
22. Use Data Entry to lower the EG RATE 4 value to 71.



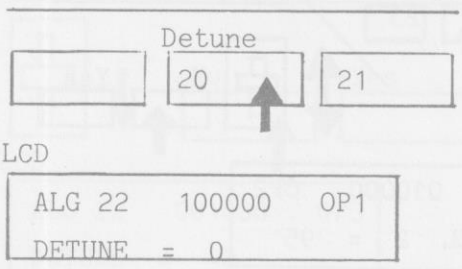
23. Press switch No. 18.



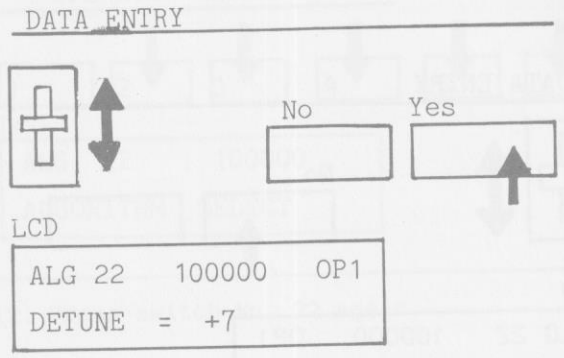
24. Press the Data Entry NO switch once.



25. Press switch No. 20.



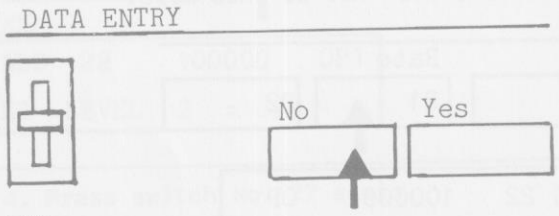
26. Use Data Entry to set Detune to +7.



LCD

```
ALG 22    100000    OP1
DETUNE  =  +7
```

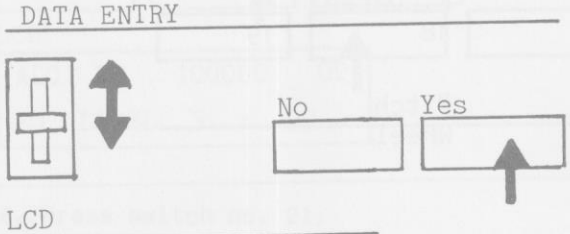
28. Press the Data Entry NO switch once.



LCD

```
ALG 22    100000    OP1
OUTPUT  LEVEL  =  98
```

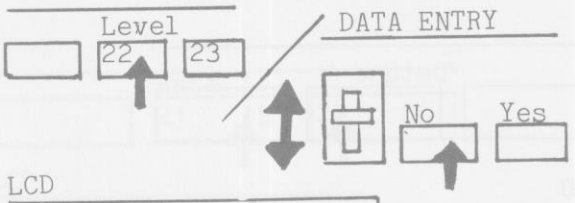
30. Use the Data Entry to raise the OUTPUT LEVEL to 86.



LCD

```
ALG 22    010000    OP2
OUTPUT  LEVEL  =  86
```

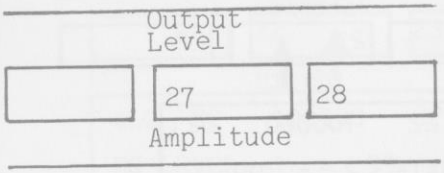
32. Press switch No. 22 again and use Data Entry to set EG LEVEL 2 to 95.



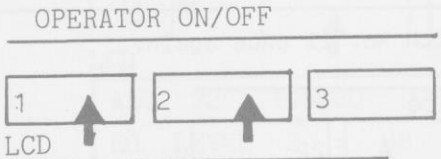
LCD

```
ALG 22    010000    OP2
EG  LEVEL  2  =  95
```

27. Press switch No. 27.



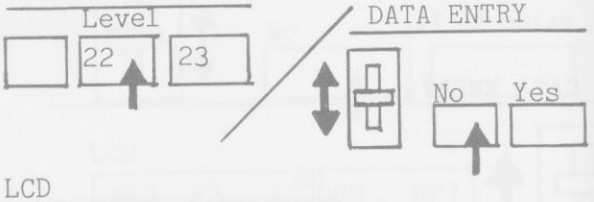
29. Press No. 1 switch, then the No. 2 switch.
* At this point there is no sound even if keys are ON. This not a malfunction.



LCD

```
ALG 22    010000    OP2
OUTPUT LEVEL  =  0
```

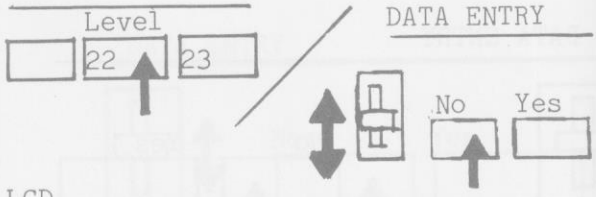
31. Press switch No. 22 and then use Data Entry to set the EG LEVEL 1 value to 82.



LCD

```
ALG 22    010000    OP2
EG  LEVEL  1  =  82
```

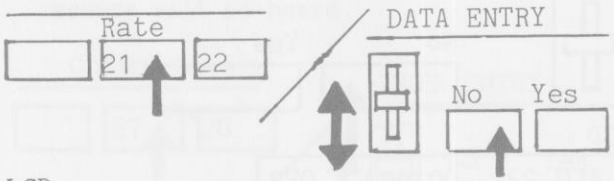
33. Press switch No. 22 once more and use Data Entry to set EG LEVEL 3 to 96.



LCD

```
ALG 22    010000    OP2
EG  LEVEL  3  =  96
```

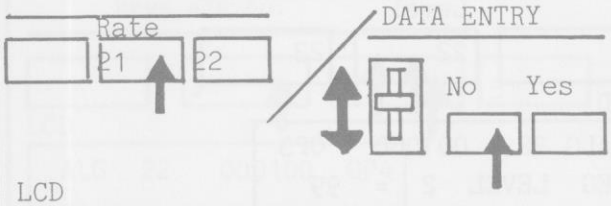
34. Press switch No. 21 and use Data Entry to set EG RATE 1 to 62.



LCD

```
ALG 22    010000    OP2
EG  RATE  1  =  62
```

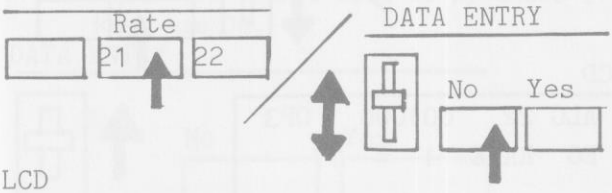
35. Press switch No. 21 again and use Data Entry to set EG RATE 2 = 51.



LCD

```
ALG 22    010000    OP2
EG  RATE  2  =  51
```

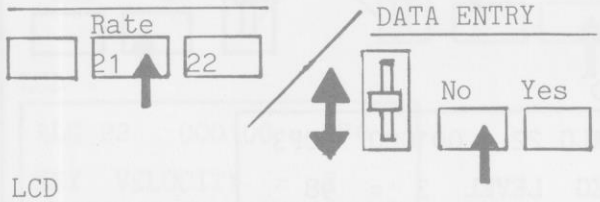
36. Press switch No. 21 again and use Data Entry to set EG RATE 3 = 29.



LCD

```
ALG 22    010000    OP2
EG  RATE  3  =  29
```

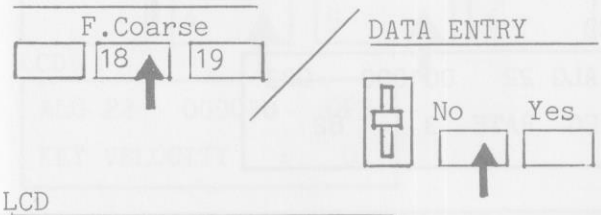
37. Press switch No. 21 again and use Data Entry to set EG RATE 4 = 82.



LCD

```
ALG 22    010000    OP2
EG  RATE  4  =  82
```

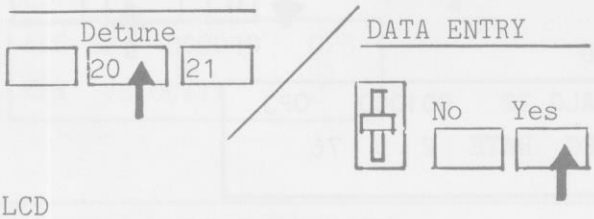
38. Press switch No. 18 and press the Data Entry NO switch once



LCD

```
ALG 22    010000    OP2
F. COARSE  =  0.50
```

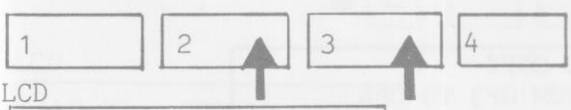
39. Press switch No. 20 and set DETUNE = +7.



LCD

```
ALG 22    010000    OP2
DETUNE  =  +7
```

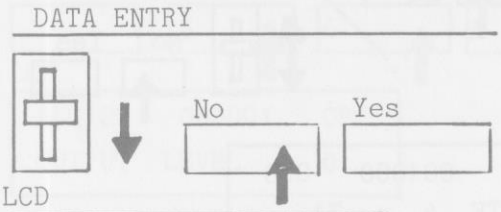
40. Press switch No. 2 and then No. 3.



LCD

```
ALG 22    001000    OP3
DETUNE  =  0
```

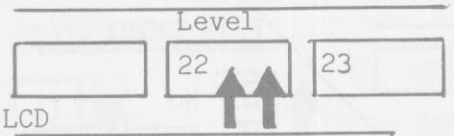
41. Use Data Entry to set DETUNE = -2.



LCD

```
ALG 22    001000    OP3
DETUNE  =  -2
```

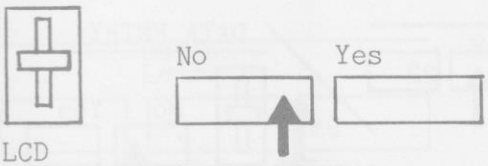
42. Press switch No. 22 twice.



LCD

```
ALG 22   001000   OP3
EG  LEVEL  2  =  99
```

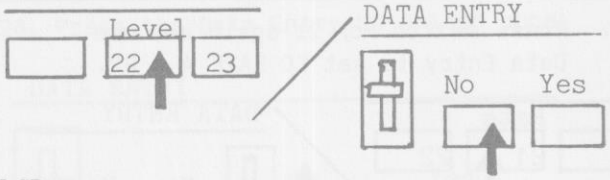
43. Use Data Entry to set EG LEVEL 2 to 98.



LCD

```
ALG 22   001000   OP3
EG  LEVEL  2  =  98
```

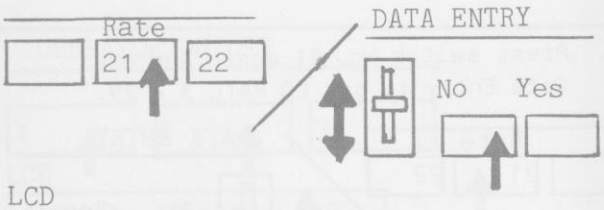
44. Press switch No. 22 again and use Data Entry to set EG LEVEL 3 to 98.



LCD

```
ALG 22   001000   OP3
EG  LEVEL  3  =  98
```

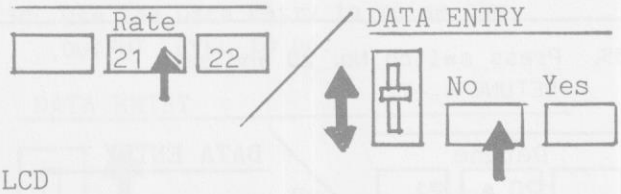
45. Press Switch No. 21 and use Data Entry to set EG RATE 1 to 77.



LCD

```
ALG 22   001000   OP3
EG  RATE  1  =  77
```

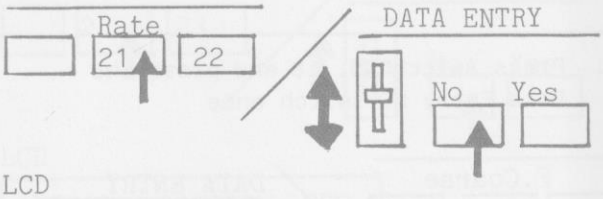
46. Press switch No. 21 again and use Data Entry to set EG RATE 2 to 76.



LCD

```
ALG 22   001000   OP3
EG  RATE  2  =  76
```

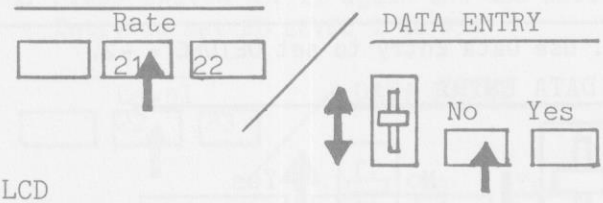
47. Press switch No. 21 again and use Data Entry to set EG RATE 3 to 82.



LCD

```
ALG 22   001000   OP3
EG  RATE  3  =  82
```

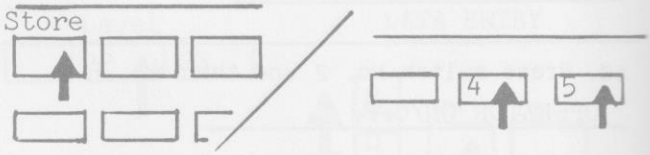
48. Press switch No. 21 again and use Data Entry to set EG RATE 4 to 71.



LCD

```
ALG 22   001000   OP3
EG  RATE  4  =  71
```

49. While holding the STORE switch depressed, press switch No. 4 and then No. 5.

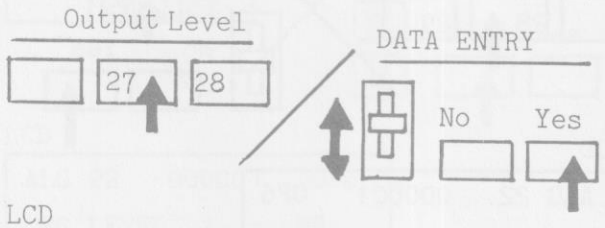


LCD

```
EG COPY
FROM OP3 TO OP4
```

```
EG COPY
FROM OP3 TO OP5
```

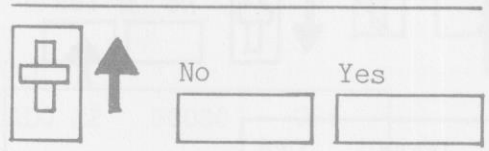
50. Press switch No. 27 and use Data Entry to set OUTPUT LEVEL = 99.
* If keys are ON at this point, sine wave sounds will be heard.



LCD

```
ALG 22   001000   OP3
OUTPUT LEVEL  =  99
```

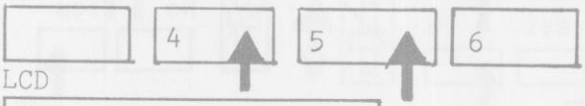
52. Use Data Entry to set OUTPUT LEVEL = 99.
* Sine wave sounds will be produced if keys are ON.



LCD

```
ALG  22 000100   OP4
OUTPUT LEVEL  =  99
```

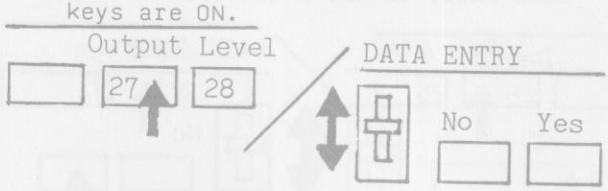
54. Press switch No. 4 and then No.5.
* No sound will be produced if keys are ON.



LCD

```
ALG 22   000010   OP5
KEY VELOCITY   =   0
```

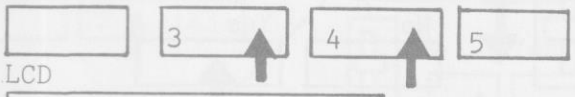
56. Press switch No. 27 and use Data Entry to set OUTPUT LEVEL = 99.
* Sine wave sounds will be produced if keys are ON.



LCD

```
ALG 22   000010   OP5
OUTPUT LEVEL  =  99
```

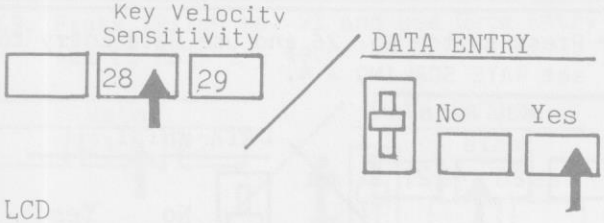
51. Press switch No. 3 and then No. 4.
* No sound will be produced even if keys are on.



LCD

```
ALG  22   000100   OP4
OUTPUT LEVEL  =  0
```

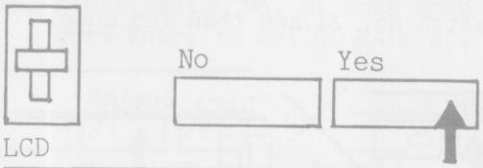
53. Press No. 28 and use Data Entry to set KEY VELOCITY = 2.



LCD

```
ALG 22   000100   OP4
KEY VELOCITY   =   2
```

55. Use Data Entry to set KEY VELOCITY = 2.



LCD

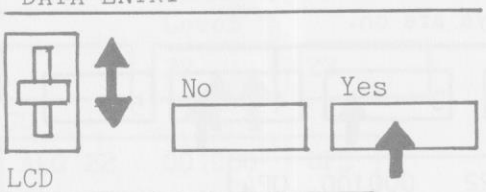
```
ALG 22   000010   OP5
KEY VELOCITY   =   2
```

57. Presses switches No. 5 and No. 6.
* No sound will be produced if keys are ON.

LCD

```
ALG 22   000001   OP6
OUTPUT LEVEL  =  0
```

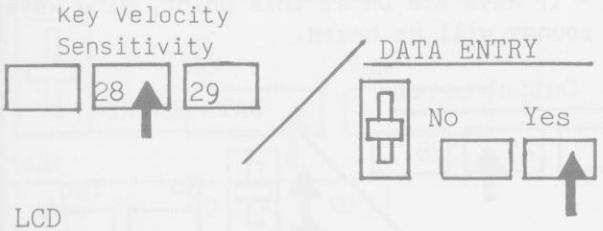
58. Use Data Entry to set OUTPUT LEVEL = 82.



LCD

```
ALG 22    000001    OP6
OUTPUT  LEVEL  =  82
```

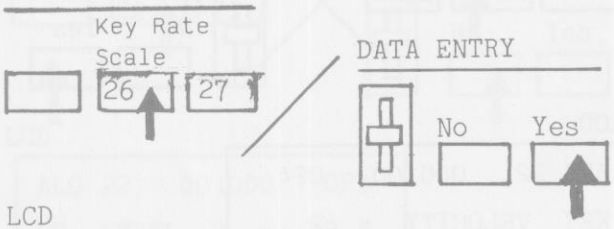
59. Press switch No. 28 and use Data Entry to set KEY VELOCITY = 2.



LCD

```
ALG 22    000001    OP6
KEY  VELOCITY  =  2
```

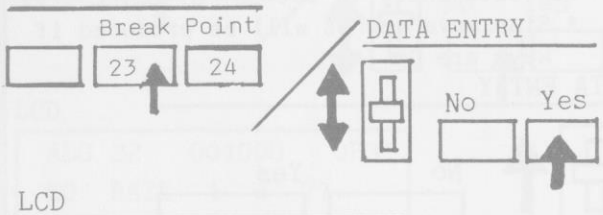
60. Press switch No. 26 and use Data Entry to set RATE SCALING = 4.



LCD

```
ALG 22    000001    OP6
RATE  SCALING  =  4
```

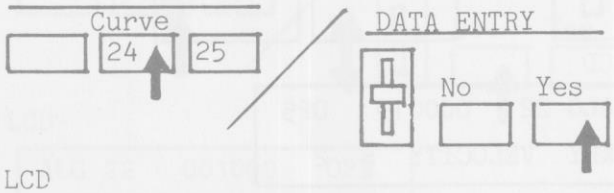
61. Press switch No. 23 and use Data Entry to set BREAK POINT = C3.



LCD

```
ALG 22    000001    OP6
BREAK POINT  =  C3
```

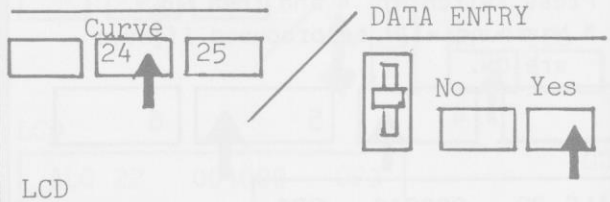
62. Press switch No. 24 and then YES once.



LCD

```
ALG 22    000001    OP6
 R  KEY  SCALE  = -EXP
```

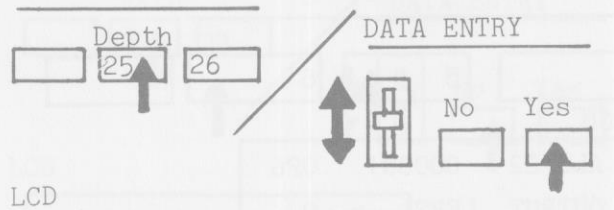
63. Press switch No. 24 again and then the YES key once again.



LCD

```
ALG 22    000001    OP6
L. KEY SCALE  =  -EXP
```

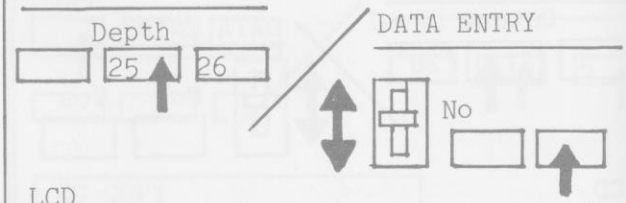
64. Press switch No. 25 and use Data Entry to set R SCALE DEPTH = 50.



LCD

```
ALG 22    000001    OP6
R  SCALE  DEPTH  = 50
```

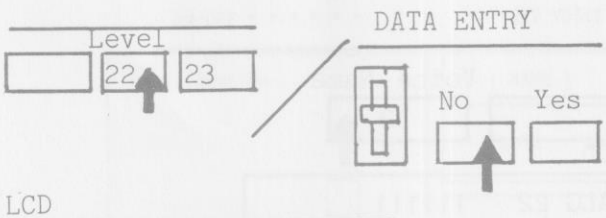
65. Press switch No. 25 once more and use Data Entry to set L SCALE DEPTH = 54.



LCD

```
ALG 22    000001    OP6
L SCALE DEPTH  =  54
```

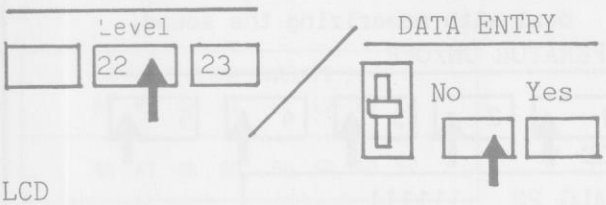
66. Press switch No. 22 and use Data Entry to set EG LEVEL 1 = 98.



LCD

```
ALG 22   000001   OP6
EG LEVEL  1  =  98
```

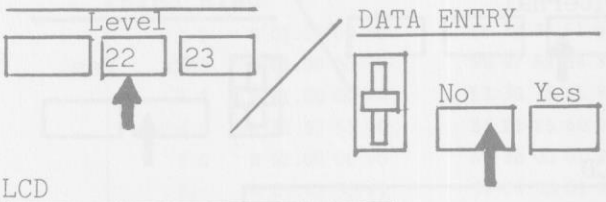
67. Press switch No. 22 again and use Data Entry to set EG LEVEL 2 = 98.



LCD

```
ALG 22   000001   OP6
EG LEVEL  2  =  98
```

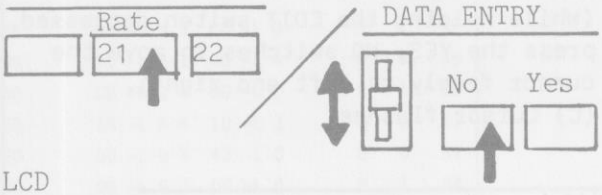
68. Press switch No. 22 once more and use Data Entry to set EG LEVEL 3 = 91



LCD

```
ALG 22   000001   OP6
EG LEVEL  3  =  91
```

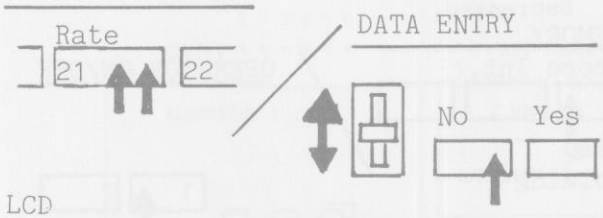
69. Press switch No. 21 and use Data Entry to set EG RATE 1 = 49.



LCD

```
ALG 22   000001   OP6
EG RATE  1  =  49
```

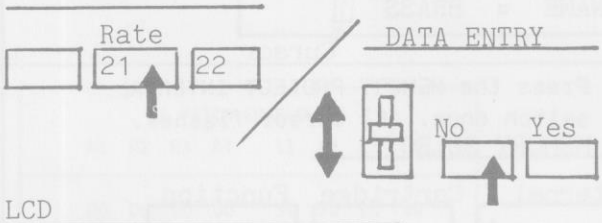
70. Press switch No. 21 twice and use Data Entry to set EG RATE 3 = 28.



LCD

```
ALG 22   000001   OP6
EG  RATE  3  =  28
```

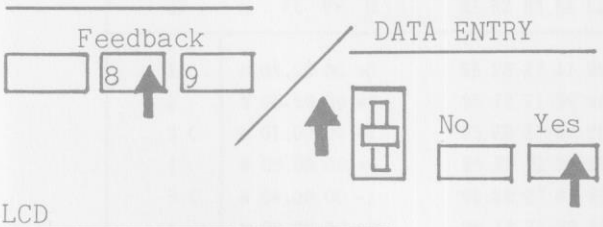
71. Press switch No. 21 once more and use Data Entry to set EG RATE 4 = 68.



LCD

```
ALG 22   000001   OP6
EG RATE  4  =  68
```

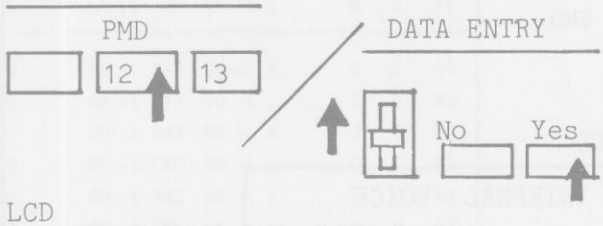
72. Press switch No. 8 and use Data Entry to set FEEDBACK =7.



LCD

```
ALG 22   000001   OP6
FEEDBACK  =  7
```

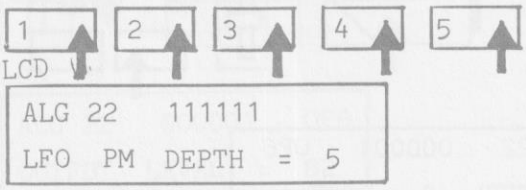
73. Press switch No. 12 and use Data Entry to set PITCH MOD DEPTH = 5.



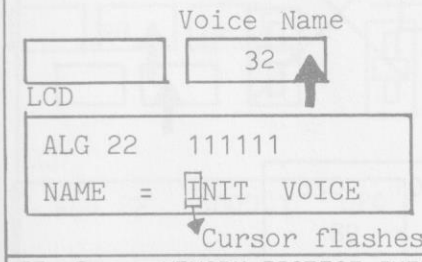
LCD

```
ALG 22   000001   OP6
LFO  PM  DEPTH  =  5
```

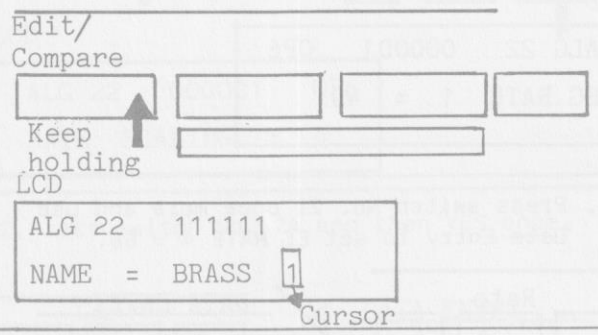
74. Press switch Nos. 1, 2, 3, 4 and 5.
* At this point the Brass sound should be produced. The following instructions deal with memorizing the sound.



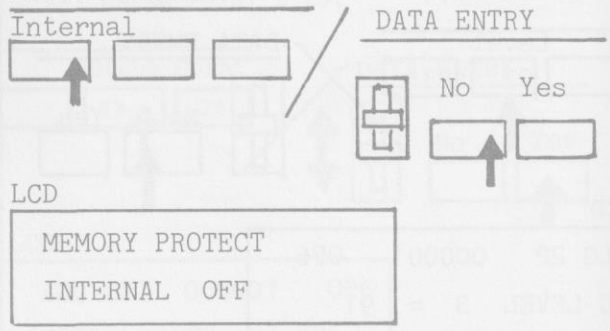
75. Press switch No. 32. A) Cursor flashes.



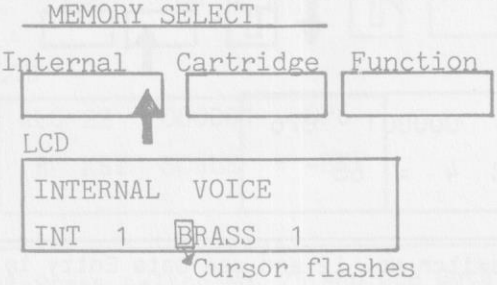
76. While holding the EDIT switch depressed, use the alphabet characters and numerals above the 32 switches to input "BRASS 1".
(B) Hold depressed.
(While holding the EDIT switch depressed, press the YES, NO switches to move the cursor freely to left and right).
(C) Cursor flashes.



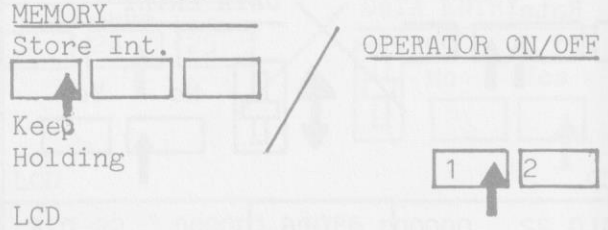
77. Press MEMORY PROTECT INTERNAL and then press the Data Entry NO switch once.
(D) Press.



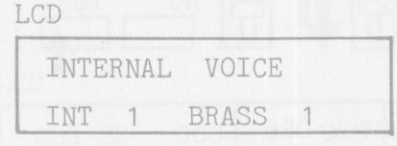
78. Press the MEMORY PROTECT INTERNAL switch once. (E) Cursor flashes.



79. While holding STORE switch depressed, press No. 1 switch. (F) hold STORE depressed.



80. END

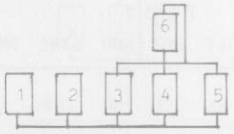


(3) INTERNAL VOICE DATA LIST FOR U.S. VERSION

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
FLUTE 1

ALGO	24
MID C	C 3
F.B	5
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
94	67	95	60	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
TRI	33	23	02	13	OFF	3

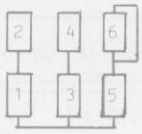
OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1 C	N	01.00	00	+0	66	72	75	61	93	89	98	00	00	-L	D 3	00	-L	0	0	1	92
2 C	N	01.00	00	+2	99	97	62	54	99	99	90	00	00	-L	A-1	00	-L	4	0	0	69
3 C	N	01.00	00	+4	53	38	75	61	88	44	24	00	00	+L	G 3	00	-L	0	0	1	68
4 C	N	01.53	53	+0	61	25	25	60	99	99	97	00	10	-L	A 4	10	-L	3	0	0	47
5 C	N	02.00	00	+0	65	38	00	61	99	00	00	00	00	-L	D 4	43	-L	0	0	0	54
6	N	01.53	53	+1	99	64	98	61	99	67	52	00	00	-L	G 3	00	+L	0	0	1	84

(1) FLUTE 1: This flute includes realistic breath sounds. The bursting sound of breath is created by FC 1.53 of OP4 and OP6. This noise sound can be made even more strident by increasing the output of OP4 by around 10.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
HARPSICH 1

ALGO	05
MID C	C 3
F.B	1
SYNC	ON

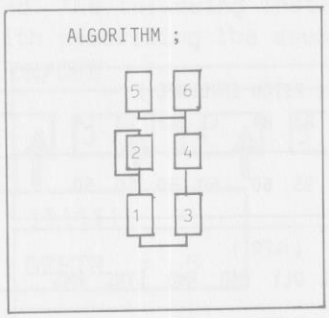
(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
00	00	00	00	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SQU	35	00	00	00	OFF	0

OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1 C	N	04.00	00	+0	95	28	27	47	99	90	00	00	00	-L	A#3	00	-L	3	0	2	89
2	N	00.50	00	+0	95	72	71	99	99	97	91	98	00	-L	A#3	00	-L	1	0	0	99
3 C	N	01.00	00	-1	95	28	27	47	99	90	00	00	00	-L	A#3	00	-L	3	0	2	85
4	N	03.00	00	+0	95	72	71	99	99	97	91	98	00	-L	C#5	46	-L	1	0	0	99
5 C	N	04.00	00	-1	95	28	27	47	99	90	00	00	00	-L	A#3	00	-L	3	0	3	83
6	N	06.00	00	+0	95	72	71	99	99	97	91	98	00	-L	C#5	55	-L	1	0	0	87

(2) HARPSICH 1: Same as the explanation for HARPSICH 1 given in the International Version.

1 2 3 4 5 6
ON/OFF * * * * * * ** DX7 VOICE DATA TABLE **



(NAME)
STRG ENS 1

ALGO	15
MID C	C 2
F.B	7
SYNC	ON

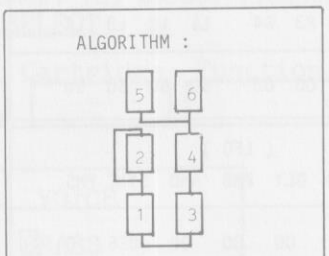
(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
98	98	98	98	53	49	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
TRI	33	35	15	00	OFF	1

OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1 C	N	02.02	01	+4	32	56	10	47	99	98	36	00	99	+L	C 3	00	+L	0	0	2	98
2	N	02.02	01	-7	77	07	07	29	93	56	28	00	00	+E	F 5	99	-L	0	0	0	81
3 C	N	02.00	00	+7	51	15	10	47	99	92	92	00	91	+L	F 4	00	-L	0	0	1	99
4	N	02.00	00	+2	49	74	10	32	98	98	98	00	56	+E	D 3	00	-L	0	0	2	72
5	N	02.00	00	-2	76	73	10	28	99	92	00	00	00	-L	A-1	00	-L	0	0	2	71
6	N	08.00	00	+5	72	76	10	32	99	92	00	00	00	-L	A-1	00	-L	0	0	2	75

(3) STRG. ENS. 1: The FC setting of OP1 and OP2 gives a great undulating quality to the overall sound. This may be considered the means of producing a rather bold DETUNE effect. When normal DETUNE parameters result in insufficient effect, setting this kind of relatively large frequency difference in the carrier is an important means of compensating the insufficiency. It should be noted that the sound can be made brighter by raising the output level of OP2 or OP4 by around 5.

1 2 3 4 5 6
ON/OFF * * * * * * ** DX7 VOICE DATA TABLE **



(NAME)
BRIGHT BOW

ALGO	15
MID C	C 2
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
94	67	95	60	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SIN	28	46	30	00	OFF	1

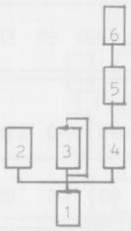
OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1 C	N	01.00	00	+0	52	30	25	43	99	92	90	00	00	-L	A-1	00	-L	2	0	1	99
2	N	01.00	00	+0	99	71	35	51	82	92	87	00	00	-L	D#4	00	-L	1	0	0	86
3 C	N	01.00	00	+0	50	52	35	41	99	92	91	00	99	+L	C 4	60	-L	2	0	1	99
4	N	01.00	00	+0	96	19	20	54	99	92	89	00	00	-L	A-1	00	-L	2	0	2	75
5	N	03.00	00	+0	53	67	38	54	86	92	74	00	00	-L	A-1	00	-L	2	0	1	84
6	N	14.00	00	+0	53	64	44	54	99	92	56	00	25	+L	E 4	00	-L	2	0	2	54

(4) BRIGHT BOW: Same as the explanation in the International Version.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
BRASSHORNS

ALGO	18
MID C	C 2
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
94	67	95	60	53	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
TRI	35	00	05	00	OFF	1

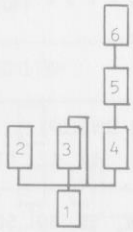
	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	01.00	00	+0	57	24	19	60	99	86	86	00	00	-L	A-1	00	-L	2	0	2	99
2	N	01.00	00	+0	37	34	15	64	85	00	00	00	00	-L	A-1	00	-L	2	0	2	67
3	N	01.00	00	+0	46	35	22	56	99	86	86	00	00	-L	A-1	00	-L	1	0	3	79
4	N	01.00	00	+0	66	92	22	50	53	61	62	00	00	-L	A-1	00	-L	0	0	1	79
5	N	03.18	06	-1	48	55	22	50	98	61	62	00	00	-L	A-1	00	-L	0	0	1	70
6	N	08.47	21	+0	77	56	20	70	99	00	00	00	00	-L	A-1	00	-L	7	0	1	79

(5) BRASS HORNS: Same as the explanation in the International Version.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
BR TRUMPET

ALGO	18
MID C	C 3
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
86	67	95	60	52	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
TRI	34	45	05	00	OFF	2

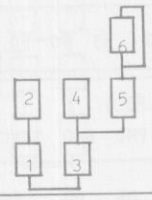
	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	01.00	00	+0	70	24	19	55	99	86	86	00	00	-L	A-1	00	-L	2	0	4	99
2	N	02.10	05	+0	99	12	22	50	85	00	00	00	00	-L	F 5	96	-E	2	0	7	50
3	N	01.00	00	+0	41	12	22	50	99	61	61	00	00	-L	A-1	00	-L	5	0	1	79
4	N	01.00	00	+0	66	76	22	50	99	61	61	00	00	-L	C 5	00	-L	5	0	4	74
5	N	06.24	04	-1	48	12	22	50	99	61	61	00	00	-L	A-1	00	-L	5	0	0	50
6	N	08.47	21	+0	42	56	20	70	99	00	00	00	00	-L	A-1	00	-L	7	0	3	99

(6) BR TRUMPET: With strong attack, a spitting sound is produced, the direct result of the FC 2.10 of OP2. Raising the output of OP2 by about 10 will produce an even more dissonant sound, but since the RATE 2 of OP2 in this case is too slow, resulting in an overly lengthy attenuation of the dissonance, it is normally best to raise RATE 2 by about 50. The FC settings of OP5 and OP6 have little effect on this sound.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
MARIMBA

ALGO	07
MID C	C 3
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
94	67	95	60	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
TRI	21	00	00	00	ON	2

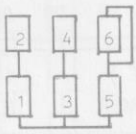
	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	01.00	00	+0	99	33	50	46	99	80	00	00	00	-L	A-1	00	-L	3	0	7	99
2	N	05.00	00	+0	99	33	46	50	99	80	00	00	00	-L	D#4	46	-L	4	0	6	60
3 C	N	01.00	00	+0	99	31	50	46	99	80	00	00	00	-L	A-1	00	-L	3	0	7	99
4	N	07.00	00	+0	90	75	00	82	82	48	00	00	00	-L	D#4	00	-L	0	0	5	91
5	N	07.00	00	+0	99	64	00	08	82	48	00	00	00	-L	D#4	46	-L	0	0	2	97
6	N	07.00	00	+0	99	77	55	00	78	78	00	00	00	-L	D 3	00	-L	0	0	4	87

(7) MARIMBA: This sound feels like it has a bit too many high harmonic components. It can be improved somewhat by lowering the output levels of OPs 4, 5 and 6 by around 10. When played staccato, the envelope is OK but the attenuation when the key is held down is a bit unnatural, leaving something to be desired. Try raising the RATE 2 of OP1 and OP3 by about 40, while lowering their RATE 3 by about 45.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
E.PIANO 1

ALGO	05
MID C	C 3
F.B	6
SYNC	OFF

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
94	67	95	60	50	50	50	50

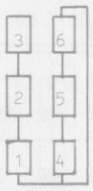
(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SIN	15	33	00	00	OFF	2

	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	01.00	00	+3	96	25	25	67	99	75	00	00	00	-L	A-1	00	-L	3	0	2	99
2	N	14.00	00	+0	95	50	35	78	99	75	00	00	00	-L	A-1	00	-L	3	0	7	58
3 C	N	01.00	00	+0	95	20	20	50	99	95	00	00	00	-L	A-1	00	-L	3	0	2	99
4	N	01.00	00	+0	95	29	20	50	99	95	00	00	00	-L	A-1	00	-L	3	0	6	89
5 C	N	01.00	00	-7	95	20	20	50	99	95	00	00	00	-L	A-1	00	-L	3	0	0	99
6	N	01.00	00	+7	95	29	20	50	99	95	00	00	00	-L	D 3	19	-L	3	0	6	79

(8) E. PIANO 1: Same as the explanation in the International Version, "E. PIANO 1".

1 2 3 4 5 6
ON/OFF * * * * * * ** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
PIANO 1

ALGO	04
MID C	C 3
F.B	5
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
00	00	00	00	50	50	50	50

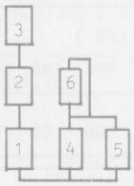
(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SQU	35	00	00	00	ON	0

	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	01.00	00	+0	88	28	27	50	99	90	00	00	00	-L	A#3	00	-L	2	0	4	99
2	N	01.00	00	+2	88	92	71	63	99	67	91	90	00	-L	C 3	13	-L	2	0	2	88
3	N	05.00	00	+2	95	28	27	47	99	90	00	00	00	-L	D 0	99	-E	2	0	3	79
4 C	N	01.00	00	+0	88	28	27	50	99	90	00	00	00	-L	A#3	00	-L	3	0	2	98
5	N	01.00	00	+3	83	00	27	50	99	90	00	00	00	-L	A#3	00	-L	2	0	3	68
6	N	01.00	00	+0	95	28	27	47	99	90	00	00	00	-L	D 0	00	-E	2	0	0	59

(9) PIANO 1: The rather metallic piano-like sound is produced by the FC 5.00 of OP3. For a piano more suited to rock music, try raising the output of OP3 by about 5, and set KV to 5. For an even brighter piano sound, set the output of OP6 to about 70, with KV of 2-3, and raise the FC to about 3.00.

1 2 3 4 5 6
ON/OFF * * * * * * ** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
PIPES 1

ALGO	19
MID C	C 2
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
94	67	95	60	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SIN	34	33	00	00	OFF	2

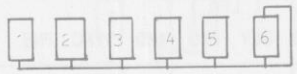
	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	00.50	00	+0	45	25	25	36	99	99	98	00	00	-L	D 3	50	-L	5	0	0	99
2	N	00.50	00	+0	99	97	62	47	99	99	90	00	00	-L	A-1	00	-L	4	0	0	90
3	N	01.00	00	+0	99	97	62	47	99	99	90	00	17	+L	G 3	40	-L	5	0	0	75
4 C	N	04.00	00	+0	61	25	25	50	99	99	97	00	10	-L	A 4	10	-L	3	0	0	88
5 C	N	02.00	00	+0	61	25	25	61	99	99	93	00	00	-L	A-1	00	-L	3	0	0	97
6	N	10.00	00	+0	72	25	25	70	99	99	99	00	10	-L	G 3	01	+L	3	0	2	76

(10) PIPES 1: Same as explanation for PIPES 1 in the International Version.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
E.ORGAN 1

ALGO	32
MID C	C 3
F.B	0
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
75	80	75	60	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
TRI	35	00	00	00	OFF	2

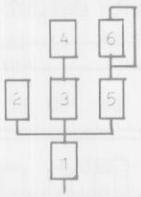
	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	00.50	00	-2	99	80	22	90	99	99	99	00	00	-L	A-1	00	-L	0	0	0	94
2 C	N	01.01	01	-6	99	20	22	90	99	99	97	00	00	-L	A-1	10	-L	0	0	0	94
3 C	N	01.50	50	+4	99	80	54	82	99	99	99	00	00	-L	A-1	00	-L	0	0	0	94
4 C	N	00.50	00	+5	99	80	22	90	99	99	99	00	00	-L	A-1	00	-L	0	0	0	94
5 C	N	01.00	00	+2	99	80	22	90	99	99	99	00	00	-L	A-1	00	-L	0	0	0	94
6 C	N	03.00	00	+0	99	54	22	90	99	00	00	00	00	-L	A-1	00	-L	0	0	0	94

(11) E. ORGAN 1: Same as explanation for E.ORGAN 1 in the International Version.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
E.BASS 1

ALGO	16
MID C	C 2
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
94	67	95	60	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
TRI	35	00	00	00	OFF	3

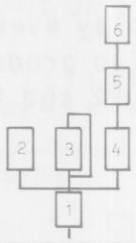
	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	00.50	00	+0	95	62	17	58	99	95	32	00	57	+L	A 2	14	-L	7	0	0	99
2	N	00.50	00	+0	99	20	00	00	99	00	00	00	00	-L	D 3	00	-L	7	0	0	80
3	N	00.50	00	+0	88	96	32	30	79	65	00	00	00	-L	A-1	00	-L	6	0	3	99
4	N	05.00	00	+0	90	42	07	55	90	30	00	00	00	-L	A-1	00	-L	5	0	5	93
5	N	00.50	00	+0	99	00	00	00	99	00	00	00	75	-L	C#4	00	-L	7	0	3	62
6	N	09.00	00	+0	94	56	24	55	93	28	00	00	00	-L	A-1	00	-L	1	0	7	85

(12) E. BASS 1: Same as explanation for E.BASS 1 in the International Version.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
CLAV 1

ALGO	18
MID C	C 3
F.B	3
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
00	00	00	00	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SIN	30	00	00	00	OFF	2

OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1 C	N	01.00	00	+1	95	92	28	60	99	90	00	00	00	-L	F	2	00	-L	3	0	7	99
2	N	00.50	00	-1	95	95	00	00	99	96	89	00	00	-L	F	2	00	-L	3	0	5	82
3	N	04.50	50	+0	98	87	00	00	87	86	00	00	00	-L	F	2	21	-L	3	0	7	85
4	N	03.00	00	+0	95	92	28	60	99	90	00	00	00	-L	F	2	00	-L	3	0	3	81
5	N	04.00	00	-2	95	95	54	00	99	96	89	00	00	-L	F	2	00	-L	3	0	4	74
6	N	12.00	00	+0	98	87	00	00	87	86	00	00	00	-L	F	2	21	-L	3	0	2	82

(13) CLAV. 1: When OP2 and OP3 are turned OFF,the sound coloring resembles that of a jazz guitar. Namely, it is OP2 which gives body to this sound. The Clavinet's unique nasal sound (in terms of waveforms, the feeling of an asymmetrical rectangular wave) is produced by OP3. By adjusting the output of these operators, a completely different sounding Clavinet will be produced. When the outputs of OPs 4, 5 and 6 are set at higher levels than their present values, the overall sound will take on a lighter touch due to the high FC setting.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :

(NAME)
HARMONICA1

ALGO	01
MID C	C 4
F.B	7
SYNC	OFF

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
94	67	95	60	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SIN	38	57	06	00	OFF	2

OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1 C	N	00.50	00	-7	54	56	28	64	92	87	00	00	00	-L	A	2	00	-L	0	0	0	00
2	N	01.00	00	+0	38	17	99	61	89	10	43	00	00	-L	A	-1	00	-L	0	1	0	00
3 C	N	01.00	00	+0	54	56	28	64	92	87	00	00	00	-L	A	2	00	-L	0	0	0	99
4	N	00.50	01	+0	38	17	99	61	89	10	43	00	00	-L	A	-1	00	-L	0	0	0	72
5	N	05.00	00	+7	65	86	98	62	98	00	98	00	00	-L	A	-1	00	-L	0	0	0	61
6	N	07.62	27	+0	99	32	98	62	99	67	52	00	00	-L	E	0	00	-L	0	0	7	41

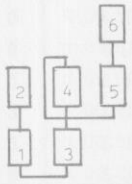
(14) HARMONICA 1: The outputs of OP1 and OP2 are set at 00. When

OP1 is raised to 99 and OP2 to 75, a harmonica sound with a sense of overall depth is produced. In terms of coloration, the sound is extremely realistic, but the attack may feel a bit sluggish. If you try raising the RATE 1 of OP1 and OP3 to about 65, and the RATE 1 of OP2 and OP4 to about 45, it will allow you to play even relatively fast phrasing. An interesting effect is also produced by slightly staggering the RATE 1 of the group OP1, OP2 and that of the group, OPs 3, 4, 5 and 6.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
JAZZ GUIT1

ALGO	08
MID C	C 2
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
75	80	75	60	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SIN	35	00	01	03	OFF	3

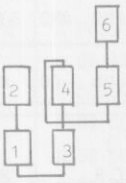
OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1 C	N	01.00	00	+0	74	85	27	70	99	95	00	00	00	-L	A-1	00	-L	4	0	3	99
2	N	03.00	00	+0	91	25	39	60	99	86	00	00	00	-L	A-1	65	-L	2	0	4	97
3 C	N	01.00	00	+0	78	87	22	75	99	92	00	00	09	-L	G 2	00	-L	3	0	7	99
4	N	03.00	00	+0	81	87	22	75	99	92	00	00	00	-L	A-1	14	-L	4	0	4	90
5	N	03.00	00	+0	81	87	22	75	99	92	00	00	00	-L	A-1	15	-L	4	0	7	92
6	N	14.00	00	+0	99	57	99	75	99	00	00	00	53	-L	C 3	20	-L	0	0	5	75

(15) JAZZ GUITAR 1: Same as explanation of Guitar 1 in the International Version. A milder guitar sound can be achieved by slightly lowering the output levels of OPs 2, 4, 5 and 6.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
PRC SYNTH1

ALGO	08
MID C	C 3
F.B	5
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
00	00	00	00	50	50	50	50

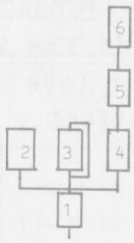
(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SIN	30	23	00	00	OFF	2

OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1 C	N	00.50	00	+1	98	72	75	61	99	99	99	00	00	-E	F 2	00	-L	0	0	2	99
2	N	00.50	00	+4	74	28	29	61	99	71	71	00	00	-L	A 3	00	-L	2	0	2	92
3 C	N	00.50	00	-1	98	72	75	61	99	89	99	00	00	-E	F 2	00	-L	3	0	3	99
4	N	00.50	00	+4	85	28	75	61	88	44	25	00	00	-L	A 3	00	-L	2	0	4	98
5	N	01.00	00	+0	85	38	75	61	88	44	25	00	00	-L	A 3	00	-L	2	0	4	86
6	N	08.00	00	-3	85	16	75	61	88	44	25	00	00	-L	C 1	62	-E	2	0	6	80

(16) PRC SYNTH 1: This is a sound similar to that of the Clavinet but with longer attenuation time, thus allowing it to be used for slow tones. A much stronger sound will be produced by raising the Level 1 of OP 4 to 99 and the FB to 6.

1 2 3 4 5 6
ON/OFF * * * * * * ** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
SAX BC

ALGO	18
MID C	C 3
F.B	7
SYNC	OFF

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
94	67	95	60	50	50	50	50

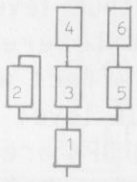
(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SIN	34	33	00	00	OFF	1

OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1 C	N	01.00	00	-7	64	11	07	65	99	99	99	00	00	-L	A-1	00	-L	0	3	0	95
2	N	00.50	00	+0	95	00	25	54	99	99	99	00	00	-L	C 3	53	-L	3	1	0	75
3	N	00-50	00	+0	99	16	14	64	99	99	98	00	00	-L	A 2	00	-L	0	2	0	76
4	N	00.50	00	+0	98	14	07	64	99	99	99	00	00	-L	A-1	00	-L	0	2	0	70
5	N	05.80	16	+7	98	10	06	62	98	99	99	00	00	-L	A-1	00	-L	0	3	0	52
6	N	00.50	00	+0	90	52	25	54	99	99	99	00	00	-L	E 0	00	-L	2	0	7	99

(17) SAX BC: Since A.M. Sens is applied to OP1-5, Function Control can be performed by Breath control to adjust sound volume and coloration. Set the Breath Control Range to 80-99, and EG BIAS to ON. If the Pitch Bender is adjusted while breathing in, an even more realistic sound will be produced.

1 2 3 4 5 6
ON/OFF * * * * * * ** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
FRETLESS 1

ALGO	17
MID C	C 2
F.B	7
SYNC	OFF

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
94	67	95	60	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SIN	31	33	00	00	OFF	2

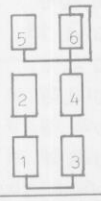
OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1 C	N	00.50	01	+0	79	36	18	63	96	70	00	00	00	-L	A 3	12	-L	3	0	2	99
2	N	00.50	01	+0	35	27	42	50	99	00	00	00	00	-L	D 3	35	-L	1	0	2	77
3	N	01.00	00	+7	73	25	32	30	97	78	00	00	00	-L	A-1	00	-L	3	0	3	68
4	N	00.50	00	+0	80	39	28	53	93	57	00	00	00	-L	A-1	00	-L	3	0	2	99
5	N	01.00	00	+0	99	51	00	00	99	74	00	00	00	-L	G 2	32	-L	4	0	2	75
6	N	00.50	00	+1	25	50	24	55	96	97	00	00	00	-L	A-1	00	-L	3	0	7	87

(18) FRETLESS 1: This is the realistic sound of an upright bass; the heart of the sound is the setting of the Rate of the OP2 envelope. Since RATE 1 of OP2 is much slower than the other operators' RATE 1, it takes time for modulation to deepen, with the result that it is delayed a bit from the instant of attack, and producing a sound like that of strings which are not held down firmly. The RATE 1 setting for OP6 also is at 26, but its effect is much more subtle than that of OP2 (the effect of OP6's RATE 1 will be better appreciated by listening to OP1, OP6, OP6 alone). Also, raising the RATE 1 of OP2 to 80-90, and lowering the FEEDBACK LEVEL 1-2, provides one means of expeditious editing. If the kind of effect produced by OP2 is not required, its Output level can be lowered to around 70, thus greatly dissipating the effect.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
HARP 1

ALGO	14
MID C	C 3
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
98	98	98	98	50	50	50	50

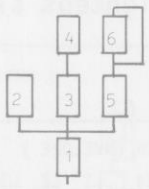
(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
TRI	27	00	01	00	OFF	3

OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1 C	N	01.00	00	+0	83	35	00	39	99	00	00	00	00	-L	C 1	28	-E	2	0	7	96
2	N	02.00	00	+0	99	60	26	71	99	00	00	00	86	-E	C 8	99	-E	2	0	6	80
3 C	N	01.00	00	+5	83	34	00	46	99	00	00	00	00	-L	C 1	28	-E	1	0	6	99
4	N	02.00	00	+0	99	34	26	39	99	00	00	00	14	-E	A 6	99	-L	2	0	5	82
5	N	05.00	00	+0	99	56	26	42	99	00	00	00	00	-L	C 1	56	-E	0	0	5	83
6	N	06.00	00	+1	96	89	26	46	99	00	00	00	00	-L	C 1	00	-E	0	0	4	84

(19) HARP 1: If the touch response of the tone coloration seems a bit over-pronounced, try adjusting as desired, by lowering the KV of OP2 and OP4. It should be remembered that the Output level will be effectively increased by the amount the KV is lowered. As a result, if you wish to weaken the touch response effect without changing the tone color, you should lower the Output level of OP2, OP4 by about 5 (or more). Also, if the FC of OP2 and OP4 are set to 1.00, and the FC of OP5 is set to 4.00, a sound like that of the Japanese koto will be produced.

1 2 3 4 5 6
ON/OFF * * * * * * ** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
TIMPANI

ALGO	16
MID C	C 3
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
98	98	75	60	50	51	50	50

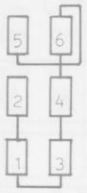
(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
TRI	11	00	16	00	OFF	2

	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	00.50	00	+0	91	36	98	33	99	00	00	00	00	-L	A-1	00	-L	3	0	7	99
2	N	00.50	00	+3	99	76	26	23	99	72	99	00	00	-L	D 3	00	-E	4	0	1	80
3	N	00.68	36	-3	99	77	26	23	99	72	00	00	00	-L	A-1	00	-E	3	0	0	85
4	N	00.87	75	+0	65	31	17	30	99	75	00	00	00	+L	D 3	15	-L	3	0	6	87
5	N	00.50	00	+0	99	50	26	19	99	00	00	00	00	+L	F 6	00	-E	0	0	1	73
6	N	00.78	56	+0	98	02	26	27	98	00	00	00	00	-L	D 3	24	-L	4	0	1	73

(20) TIMPANI: This is an extremely well-programmed sound, a typical example of the effects of a good F.F.setting. An envelope setting like that described in Chapter 3 is used, so that release is produced by staccato playing, and muting is produced when keys are held down. When the Output level of OP2 is raised 5-15, the non-dissonant drumming sound components are increased. By raising this value, the tension of the timpani skins can be increased. When OPs 3, 4, 5 and 6 are raised, an extremely eccentric drumming sound is created. Try playing this sound while perfecting your use of the Pitch Bender.

1 2 3 4 5 6
ON/OFF * * * * * * ** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
HEAVYMETAL

ALGO	14
MID C	C 3
F.B	2
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
00	00	00	00	50	50	50	50

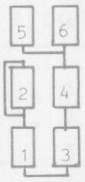
(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
TRI	33	42	04	99	OFF	4

	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	00.50	00	+1	99	00	12	70	99	99	99	00	00	-L	F 2	00	-L	1	0	0	95
2	N	00.50	00	+4	99	31	00	00	99	00	00	00	00	-L	F 2	00	-L	0	0	0	90
3 C	N	00.50	00	+0	87	77	79	33	41	98	90	00	00	-E	F 2	00	-L	3	0	0	95
4	N	02.00	00	-1	99	49	99	44	99	83	98	00	00	-L	A 3	00	-L	2	0	0	76
5	N	00.50	00	-2	87	77	79	33	41	98	90	00	00	-L	F 2	00	-L	5	0	0	99
6	N	03.00	00	+5	98	49	98	44	99	83	98	00	99	-E	F 2	19	-L	2	0	0	92

(21) HEAVY METAL: Due to the level settings of OP4 and OP6, two consecutive sounds are produced for each Key ON. If this unique effect is not required, adjust the Level 3 of OP4 and OP6 either equal to or lower than that of Level 2. Also, set the RATE 2 of OP4 and OP6 to about 20. When RATE 3 is also set to about 20, an effect will be produced in which the sound darkens and brightens slowly.

1 2 3 4 5 6
ON/OFF * * * * * * ** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
STEEL DRUM

ALGO	15
MID C	C 3
F.B	5
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
50	50	50	50	50	50	50	50

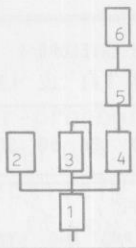
(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SIN	25	00	10	99	OFF	2

	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	01.00	00	+0	99	40	33	38	99	92	00	00	00	+L	A-1	00	+L	4	0	4	99
2	N	01.70	70	+0	99	19	20	09	99	87	00	00	00	+E	F#4	71	-L	2	0	4	64
3 C	N	01.00	00	+0	99	30	35	42	99	92	00	00	00	-L	A-1	00	-L	3	0	5	99
4	N	02.00	00	+7	99	44	50	21	91	82	00	00	00	-L	A-1	00	-L	3	0	3	88
5	N	05.32	33	+0	99	40	38	00	91	82	00	00	00	-L	A-1	00	-L	3	0	2	64
6	F	398.1	60	+0	99	49	28	12	91	82	00	00	00	-L	A-1	00	-L	3	0	3	49

(22) STEEL DRUM: Same as the explanation for STEEL DRUM in International Version.

1 2 3 4 5 6
ON/OFF * * * * * * ** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
SYN-LEAD 1

ALGO	18
MID C	C 4
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
00	00	00	00	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SQU	37	42	04	99	OFF	4

	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	00.50	00	+1	99	00	12	70	99	99	99	00	00	-L	F 2	00	-L	1	0	0	85
2	N	00.50	00	-1	99	20	00	00	99	99	99	00	00	-L	F 2	00	-L	0	0	0	82
3	N	04.00	00	+0	99	99	99	00	96	92	92	00	99	-E	F 2	00	-L	0	0	7	78
4	N	00.50	00	+2	99	20	20	60	99	90	00	00	00	-L	A 3	00	-L	0	0	7	86
5	N	01.50	50	-5	99	02	97	00	99	65	60	00	00	-L	F 2	00	-L	1	0	7	56
6	N	10.00	00	+5	99	20	60	00	99	99	97	00	99	-E	F 2	19	-L	3	0	7	62

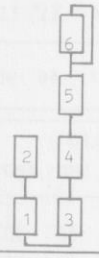
(23) SYN-LEAD 1: With this sound, the square wave Pitch MOD is

pre-set. The envelopeis almost linear, meaning that the sound coloration is produced by virtually the FC and Output level alone. Since this is a rather light sound, you may wish to try a lower setting of the FC for OP3 and OP6.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
VOICES BC

ALGO	01
MID C	C 3
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
18	25	98	98	47	47	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SIN	34	35	56	02	OFF	1

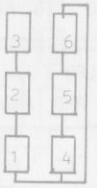
	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	01.00	00	-7	34	20	53	42	99	85	85	00	00	-L	A-1	00	-L	0	3	0	89
2	N	01.02	02	+0	60	30	53	25	69	75	75	51	00	-L	A-1	00	-L	0	3	1	99
3 C	N	01.01	01	+7	33	20	53	42	99	94	97	00	00	-L	A-1	00	-L	0	3	3	99
4	N	01.02	02	+3	72	19	41	12	48	58	20	09	00	-L	A-1	00	-L	0	0	1	99
5	N	01.01	01	-1	35	21	36	63	99	90	85	00	00	-L	A-1	00	-L	0	0	1	53
6	N	05.10	02	+1	99	72	48	17	99	99	99	00	00	-L	A-1	00	-L	0	0	0	55

(24) VOICES BC: If the Function Control's Breath EG BIAS is set to ON, you can control the sound volume and coloration by breath. If you feel the attack is too slow, try raising the RATE 1 of OP2 and OP3. However, since Pitch EG is also applied to this sound, if the RATE 1 is raised about 10, the pitch envelope's L1, L2 should be lowered 1-2, to lower the width of the attack intervals.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
CLAV ENS

ALGO	04
MID C	C 3
F.B	0
SYNC	OFF

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
99	98	75	60	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
TRI	35	00	00	00	OFF	2

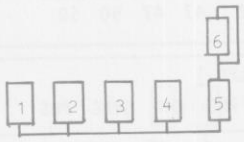
	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1 C	N	00.50	00	+0	80	32	18	66	99	95	00	00	00	-L	A-1	00	-L	4	0	3	99
2	N	00.50	00	+7	99	39	21	30	99	85	00	00	00	-L	A-1	00	-E	0	0	2	93
3	N	03.00	00	+0	95	17	17	66	99	95	00	00	99	+E	B	2	99	-E	0	0	4	77
4 C	N	02.00	00	+0	95	99	23	84	99	99	00	00	00	-L	A-1	00	-E	7	0	3	99
5	N	00.50	00	+0	99	42	15	99	99	61	00	00	00	-L	G	0	00	-E	0	0	2	91
6	N	12.00	00	+3	93	05	17	30	76	51	00	00	32	-L	G	0	00	-E	2	0	1	67

(25) CLAV. ENS.: This sound has a substantially stronger impact than the CLAV 1 described in No. 13. If the KV of OP3 and OP6 feels a bit insufficient, you may wish to raise them by 5 or 6. This will allow you to give fuller expression to the nuances of touch.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
LASERSWEEP

ALGO	31
MID C	C 2
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
29	98	35	17	56	95	45	99

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SAW+	43	70	98	00	OFF	7

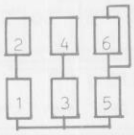
OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1	C	N	05.00	00	+0	99	38	40	15	99	00	00	00	00	-L	A-1	00	-L	0	0	99
2	C	N	19.38	02	+0	99	55	75	18	99	32	99	00	00	-L	A-1	00	-L	0	0	86
3	C	N	17.17	01	+0	99	82	98	17	99	00	98	00	00	-L	A-1	00	-L	0	0	65
4	C	N	02.22	11	+0	99	82	98	15	99	00	98	00	00	-L	A-1	00	-L	0	0	61
5	C	N	00.50	01	+0	99	82	98	15	99	00	98	00	00	-L	A-1	00	-L	0	0	98
6		N	00.50	01	+0	25	21	98	15	99	00	99	00	00	-L	G	0	00	-E	0	0	84

(26) LASERSWEEP: This is a sound effect produced by a skilful combination of the Pitch envelope and LFO MOD. Once you have pressed a key on, wait until the effect of the pitch envelope ends before releasing. You may also wish to try varying the types of LFO wave. A simple algorithm is used, but it is an extremely good example of sound coloration by the process OPsl, 2, 3, 4 and 6 ---- OP5.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
TUB ERUPT

ALGO	05
MID C	C 3
F.B	4
SYNC	OFF

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
67	95	95	60	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SAW-	35	00	00	00	OFF	6

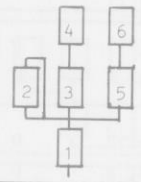
OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1	C	N	01.00	00	+2	95	33	71	25	99	00	32	00	00	-L	A-1	00	-L	2	0	95
2		N	03.50	75	+3	98	12	71	28	99	00	32	00	00	-L	A-1	00	-L	2	0	78
3	C	N	01.00	00	-5	95	33	71	25	99	00	32	00	00	-L	A-1	00	-L	2	0	99
4		N	03.50	75	-2	98	12	71	28	99	00	32	00	00	-L	A-1	00	-L	2	0	75
5	C	N	00.50	00	+0	69	11	71	28	99	00	32	00	00	-L	A-1	00	-L	0	0	99
6		N	00.50	00	+0	19	12	71	28	99	00	32	00	00	-L	A-1	00	-L	0	0	98

(27) TUB ERUPT: In this example, a sound with high metallic harmonics is produced by the combination of OP2 --- OP1, and OP4 --- OP3, and mixed to that sound is the low-range interval components produced by OP6 --- OP5. Since the settings of the operator levels are like the outline of a pair of mountains, once a key is pressed ON and held depressed, the sound slowly rolls out again. If this effect is not desired, set the LEVEL 3 of each operator to 0.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)

GRAND PRIX

ALGO	17
MID C	C 3
F.B	7
SYNC	ON

(PITCH ENVELOPE)

R1	R2	R3	R4	L1	L2	L3	L4
12	78	45	98	99	89	11	00

(LFO)

WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SAW-	99	00	00	00	OFF	7

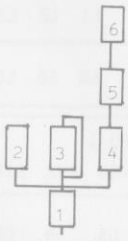
OP	(FREQ) M FC FF D	(ENVELOPE) R1 R2 R3 R4 L1 L2 L3 L4	(KEY SCALE) LD LC BP RD RC R	(S) M V TL
1 C	N 04.00 00 +0	29 21 20 50 99 35 28 00	23 +E C#3 00 +E 3	0 0 92
2	N 02.00 00 +0	93 40 13 36 69 88 59 00	36 -L F 1 00 -E 4	0 0 89
3	N 00.50 00 +0	53 29 25 30 99 85 52 00	19 -L E 3 04 -E 3	0 2 99
4	N 00.50 00 +0	40 32 83 30 99 68 00 00	13 +E A 4 00 -E 2	0 5 99
5	N 00.50 00 -5	47 20 69 33 82 62 42 00	00 -L A-1 00 -E 2	0 7 55
6	N 00.50 00 +0	32 21 38 30 82 68 00 00	13 +E F#2 18 -E 2	0 0 80

(28) GRAND PRIX: This sound produces the feeling of Formula 1 racing cars roaring past. The production of the sound itself is extremely easy, with the pitch envelope setting taking primary credit for the ultimate sound. A more realistic sound is produced by pressing new keys ON one after the other.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)

REFS WHISL

ALGO	18
MID C	C 3
F.B	2
SYNC	ON

(PITCH ENVELOPE)

R1	R2	R3	R4	L1	L2	L3	L4
38	67	95	60	39	50	50	50

(LFO)

WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
S/H	99	00	00	00	ON	6

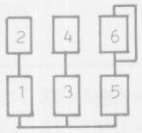
OP	(FREQ) M FC FF D	(ENVELOPE) R1 R2 R3 R4 L1 L2 L3 L4	(KEY SCALE) LD LC BP RD RC R	(S) M V TL
1 C	F 2089. 32 +0	60 39 28 49 99 99 99 00	00 -L A-1 00 -L 4	0 1 90
2	F 33.88 53 +0	60 39 28 45 99 99 99 00	00 -L A-1 00 -L 4	0 0 93
3	F 46.77 67 +0	60 39 08 00 99 99 99 00	00 -L A-1 00 -L 4	0 0 66
4	F 6607. 82 +0	94 68 24 55 96 89 00 00	00 -L A-1 00 -L 1	0 0 75
5	F 1.000 00 +0	99 00 00 00 99 00 00 00	00 -L D 3 00 -L 0	0 0 64
6	F 10.00 00 +0	94 56 24 55 96 78 00 00	00 -L A-1 00 -L 1	0 0 78

(29) REFS WHISL: Same as the explanation for REFS WHISL in the International Version.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
TRAIN

ALGO	05
MID C	C 3
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
75	67	95	60	50	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SAW-	39	00	00	97	OFF	1

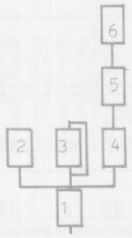
	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1	C	N	01.64	64	+0	65	24	19	57	99	85	85	00	99	-L	F	3	99	-L	3	0	0	99
2		N	03.03	01	+0	39	13	12	72	99	61	66	00	99	-L	F	3	99	-L	5	0	0	72
3	C	F	371.5	57	+2	98	29	28	33	99	00	00	00	98	-E	C	8	00	-E	0	0	0	99
4		F	977.2	99	-2	98	29	28	27	99	00	00	00	00	-E	F	1	00	-E	0	0	0	89
5	C	N	00.50	00	-2	42	17	25	53	99	99	99	99	00	+L	A	2	83	-L	0	3	0	80
6		F	2.089	32	+7	49	17	25	53	99	99	99	98	71	-E	A	2	99	-L	0	1	0	99

(30) TRAIN: This is a sound effect skilfully utilizing parallel algorithms. The train whistle is produced by OP2 --- OP1, the crossing bell by OP4 --- OP3, and the steam locomotive's sound by OP6 --- OP5, with level scaling spread through three positions on the keyboard. Pay special attention to the method of scaling for the whistle sound. With the break point at the center, if -L scaling is applied to the left and right, the sound will be produced only from the vicinity of the break point. Care must be taken if the Function control's EG BIAS is ON, since the sound of the locomotive which uses the AM will almost disappear.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM:



(NAME)
BRASS S H

ALGO	18
MID C	C 2
F.B	7
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
86	67	95	60	54	50	50	50

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
S/H	42	00	05	99	ON	2

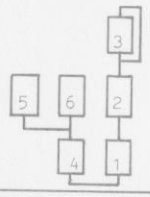
	(FREQ)				(ENVELOPE)								(KEY SCALE)						(S)		
OP	M	FC	FF	D	R1	R2	R3	R4	L1	L2	L3	L4	LD	LC	BP	RD	RC	R	M	V	TL
1	C	N	01.00	00	+0	70	24	19	55	99	95	95	00	00	-L	A-1	00	-L	2	0	0	99
2		N	01.00	00	+7	99	99	99	50	99	99	99	00	00	-L	C#2	99	-L	2	3	0	96
3		N	01.00	00	-1	41	12	22	50	99	95	95	00	00	-L	A-1	00	-L	5	0	2	81
4		N	01.00	00	+3	66	76	22	50	99	65	65	00	00	-L	C 5	00	-L	5	3	4	74
5		N	06.24	04	-4	48	12	22	50	99	61	61	00	00	-L	A-1	00	-L	5	3	4	50
6		N	08.47	21	+0	42	56	20	70	99	00	00	00	00	-L	A-1	00	-L	7	3	3	99

(31) BRASS S/H: Since AM is being applied to the modulator by the Sample and Hold wave, when a key is pressed ON the sound coloration will change at random. The pitch envelope is also being applied, but if this is not desired, set the LEVEL 1 of the pitch envelope to a value of 50.

1 2 3 4 5 6
ON/OFF * * * * * *

** DX7 VOICE DATA TABLE **

ALGORITHM :



(NAME)
TAKE OFF

ALGO	10
MID C	C 1
F.B	0
SYNC	ON

(PITCH ENVELOPE)							
R1	R2	R3	R4	L1	L2	L3	L4
32	30	94	16	50	07	81	99

(LFO)						
WAVE	SPD	DLY	PMD	AMD	SYNC	PMS
SAW+	65	00	00	00	ON	5

OP	(FREQ) M	FC	FF	D	(ENVELOPE) R1	R2	R3	R4	L1	L2	L3	L4	(KEY SCALE) LD	LC	BP	RD	RC	R	(S) M	V	TL
1 C	N	04.04	01	+0	09	14	17	34	61	96	00	00	00	-L	A-1	00	-L	0	0	0	99
2	N	01.00	00	+0	82	80	19	14	80	95	00	00	00	-L	A-1	00	-L	0	0	0	96
3	N	06.06	01	+0	76	35	99	11	67	38	73	00	00	-L	A-1	00	-L	0	0	0	99
4 C	N	00.50	00	+0	13	14	20	30	99	95	99	00	00	-L	A-1	00	-L	0	0	0	99
5	N	02.02	01	+0	88	24	23	37	99	90	00	00	00	-L	A-1	00	-L	0	0	0	96
6	N	00.50	00	+0	89	22	20	41	99	92	00	00	00	-L	A-1	00	-L	0	0	0	99

(32) TAKE OFF: Same as the explanation for TAKE OFF in the International Version. (Try varying the pitch envelope's RATE 1, 2).

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